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FINAL
REGIONAL ENVIRONMENTAL ANALYSIS
ON
GEOTHERMAL LEASING
IN THE
TONOPAH RESOURCE AREA

UNITED STATES
DEPARTMENT OF THE INTERIOR

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U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
BATTLE MOUNTAIN DISTRICT
Battle Mountain, Nevada

FINAL
REGIONAL ENVIRONMENTAL ANALYSIS
ON
GEOTHERMAL LEASING
IN THE
TONOPAH RESOURCE AREA

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Planning Background:

1. MFP Completed.
2. URA Completed.
3. County Zoning Ordnance in Effect.

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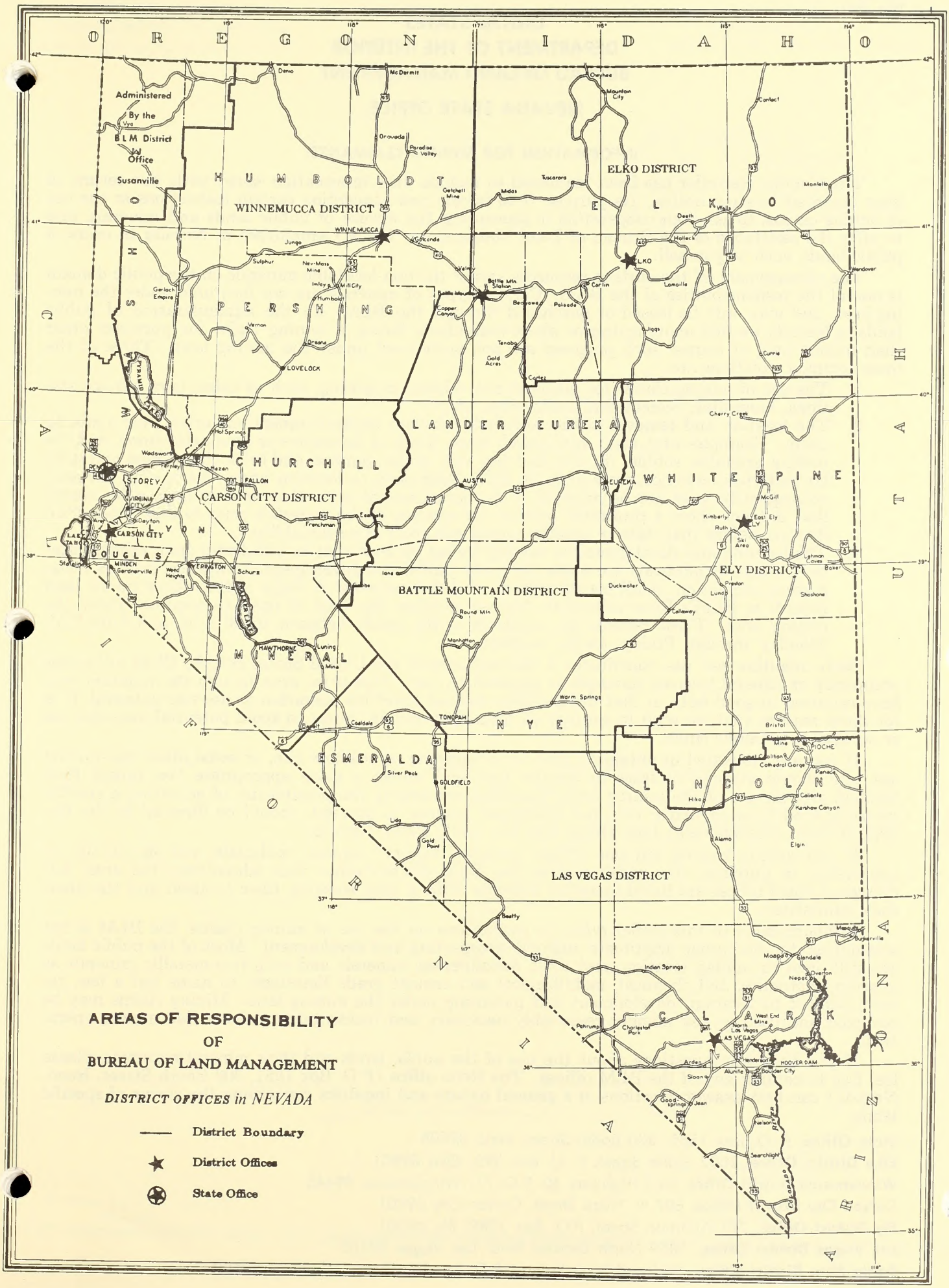
The "Technical Report on Geothermal Energy Development" (N-8672)
by
Robert T. Webb, Nevada State Office
Bureau of Land Management, is hereby
included in this document by reference.



AREAS OF RESPONSIBILITY OF BUREAU OF LAND MANAGEMENT

DISTRICT OFFICES in NEVADA

—— District Boundary

★ District Offices

⊛ State Office

NSO-114
(Nov. 1963)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NEVADA STATE OFFICE

INFORMATION FOR MINING CLAIMANTS

The County Recorder has been requested to include this information sheet with the return of your recorded location notice. Its purpose is to inform you concerning certain restrictions in the use of mining claims, to ask your cooperation in preventing the misuse of public lands and minerals, and to offer the assistance of the Bureau of Land Management (BLM) employees in Nevada to users of public lands, such as yourself.

The management of the surface resources and of the non-locatable minerals on the public domain is one of the responsibilities of the BLM. Certain types of minerals are *not locatable* under the mining laws, and may only be leased or purchased through the BLM. In the administration of public lands in Nevada we find many instances where individuals locate a mining claim for purposes other than mining and, of course, such purposes are not authorized under the mining laws. Three of the most common violations are:

1. The use of mining claims for purposes not related to mining, such as cafes, bars, service stations, homesites, recreational cabin sites, etc.
2. The location and removal of the so-called "common variety" mineral materials from a mining claim. Examples are: sand and gravel, many kinds of decorative or ornametal stone, rock for roofing granules, rubble, fill dirt and top soil, cinder, pumice, and brick clay. These and similar materials have not, since July 23, 1955, been open to location under the mining law and, consequently, may not be removed from claims located after that date or from older claims that did not show a profitable market for any one of the materials prior to that date. (Production before that date is usually considered proof of marketability).
3. The location and development of mining claims on land that is withdrawn from mining location. Such withdrawals are made for many public and governmental purposes, such as reclamation, recreation, small tracts, military and defense uses. A check of the official public land records in BLM's Reno office will disclose whether the land is open to location under the mining laws. These records are available to the public between 10:00 A.M. and 3:00 P.M. Monday through Friday, except holidays.

Such unauthorized use constitutes a trespass against the United States and the BLM will assess occupancy or mineral trespass damages as required by law. This is so, even though the violation may have occurred in good faith in that the claimant did not know his operation or use was unlawful. It is for these reasons that we wish to caution all owners of mining claims to avoid potential unlawful use or occupancy of public lands.

If you are interested in obtaining land for a homesite, a business site, or some other non-mining use, you should attempt to lease or acquire this land under a more appropriate law rather than through any misuse of the mining laws. Inquiries concerning the possibilities of acquiring a specific parcel of land for a particular use, and the proper manner to proceed, should be directed to the Bureau of Land Management, Post Office Box No. 1551, Reno, Nevada.

If you wish to remove any one of the "common variety" mineral materials, you should file an application to purchase this material from the BLM district office that administers the area. Addresses of these offices are listed hereafter together with a map showing their location and the areas they administer.

Although most of this leaflet refers to restrictions on the use of mining claims, the BLM is not attempting to discourage legitimate mineral prospecting and development. Most of the public lands are still open to mining location, and most metalliferous minerals and such non-metallic minerals as gypsum, diatomite, and chemical, metallurgical and cement grade limestone, to name but a few, remain subject to location, development and patenting under the mining laws. Mining claims may be occupied and used in any manner reasonably necessary and incidental to a bona fide mining operation.

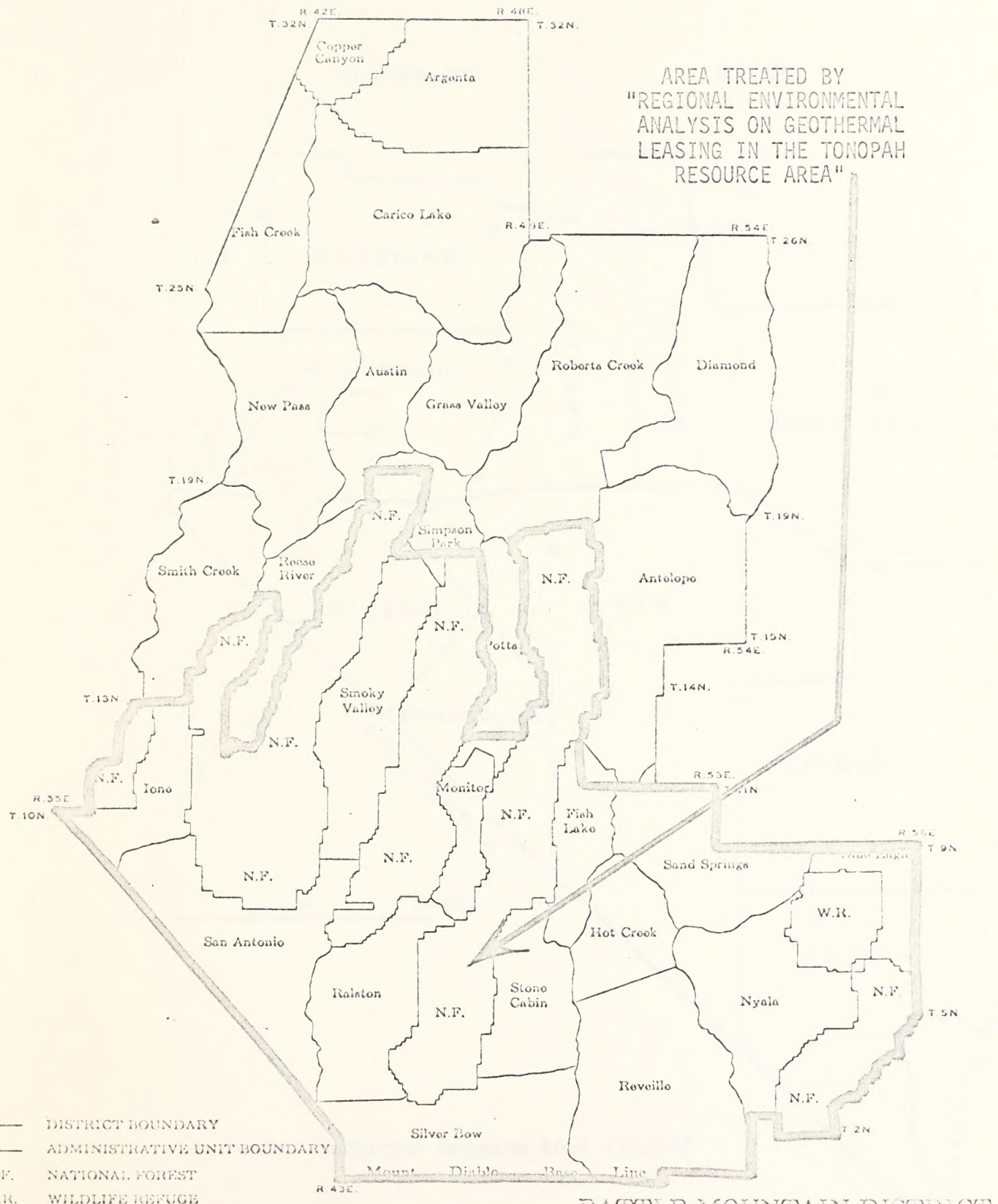
If you have any questions about the use of the public lands and their mineral resources, please feel free to contact any of the BLM offices. The Reno office (P.O. Box 1551, 300 Booth Street, Reno, Nevada) can best answer questions of a general nature and inquiries concerning the status of specific lands.

State Office, P. O. Box 1551, 300 Booth Street, Reno 89505
Elko District Office, 2002 Idaho Street, P. O. Box 592, Elko 89801
Winnemucca District Office, East Highway 40, P.O. 71, Winnemucca 89445
Carson City District Office, 807 N. Plaza Street, Carson City 89701
Ely District Office, 777 Aultman Street, P.O. Box 1289, Ely 89301
Las Vegas District Office, 1859 North Decatur Blvd. Las Vegas 89107
Battle Mtn. District Office, 2nd and Scott Streets, P.O. Box 194, Battle Mountain 89820

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NEVADA

ENGINEERING DIVISION
RANGE AND FORESTRY DIVISION



BATTLE MOUNTAIN DISTRICT
ADMINISTRATIVE UNITS

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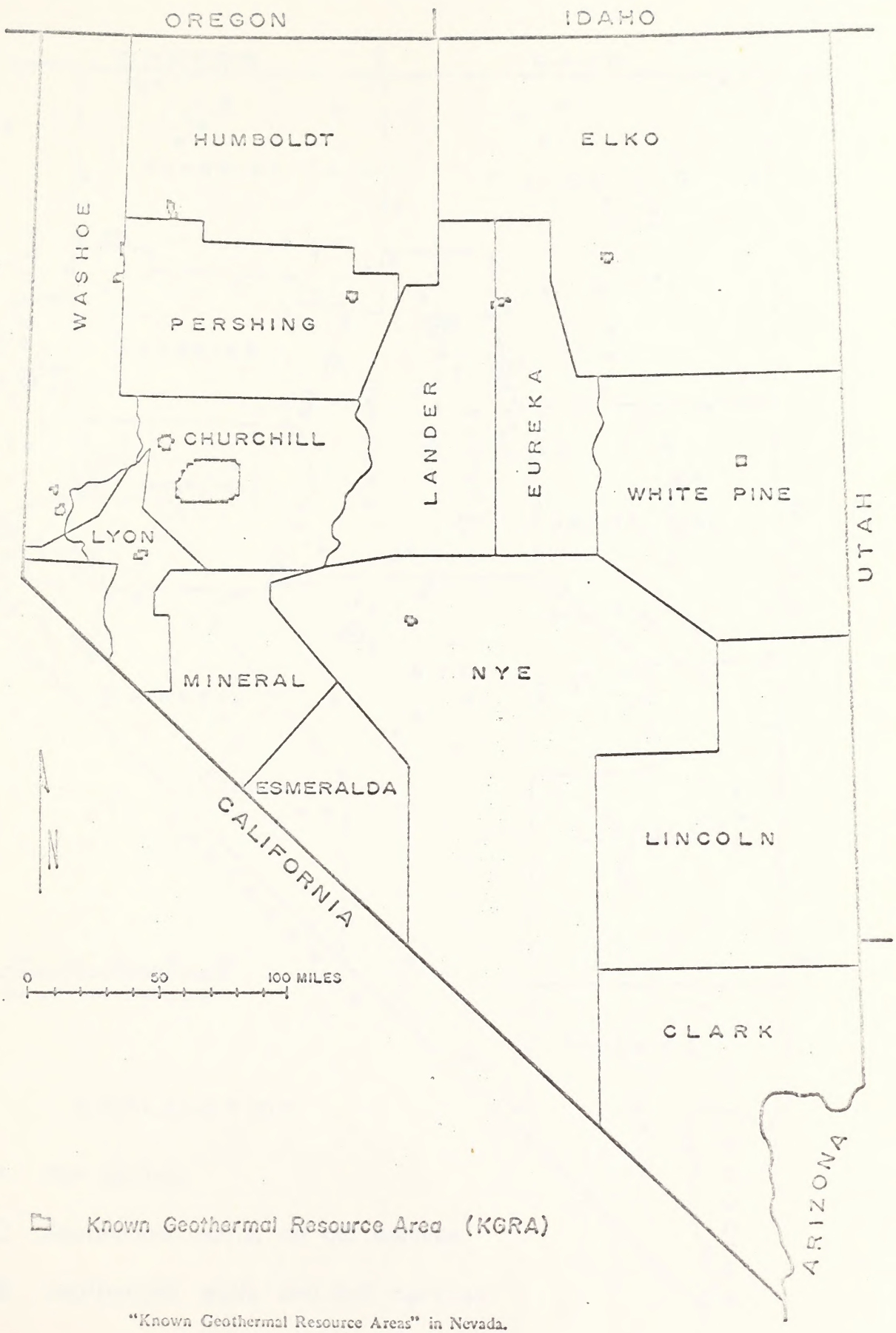
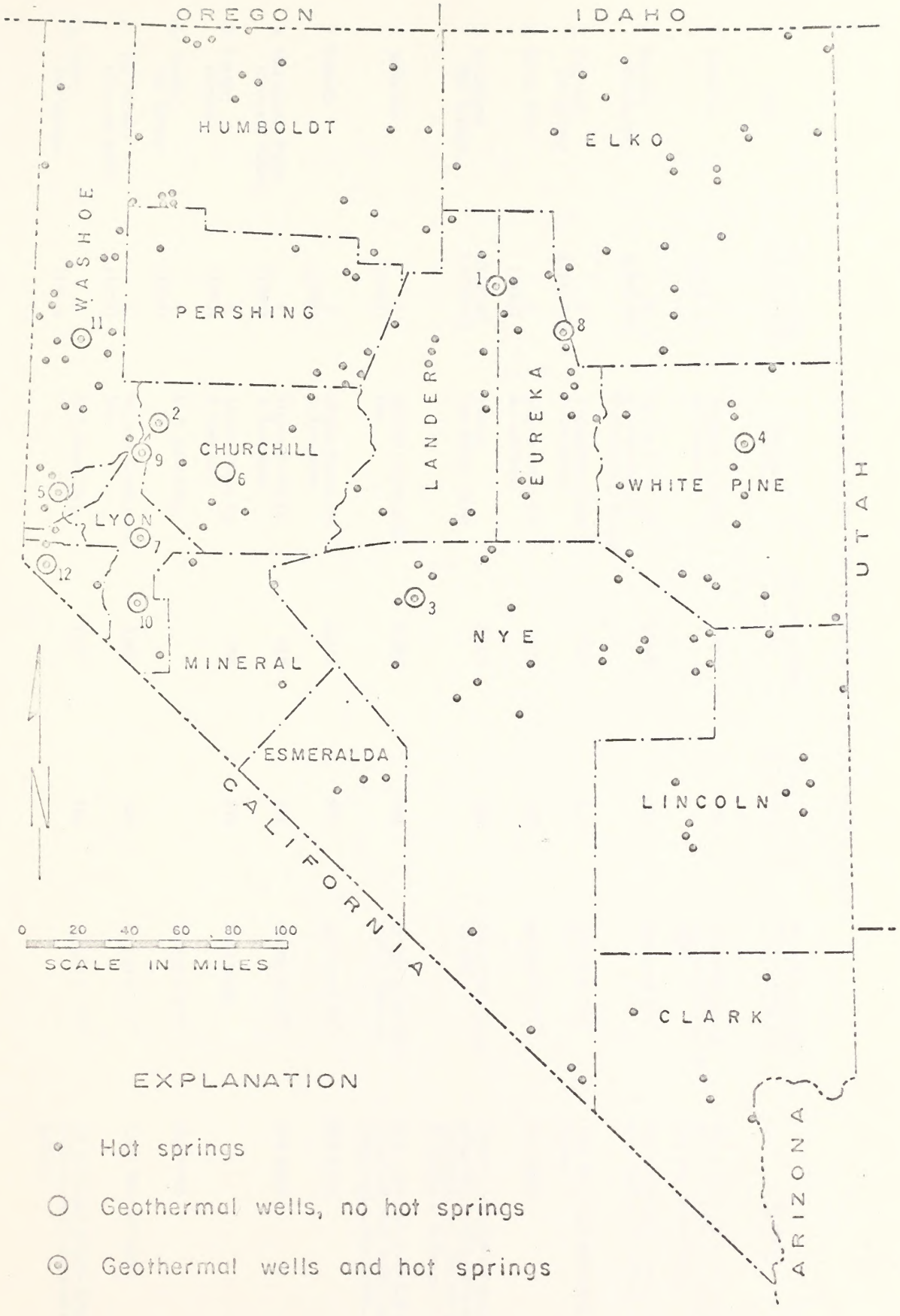
January 1963

Administrative Unit mapping is available at
Bureau of Land Management State Office
50 Ryland Street, P.O. Box 1551
Reno, Nevada



"Known Geothermal Resource Areas" in Nevada.



Hot springs and geothermal wells in Nevada

EXPLORATORY GEOTHERMAL DRILLING IN NEVADA*

Area	Number Wells (when drilled)	Operator	Maximum Depth (ft.)	Maximum Well Temperature (°F)	Maximum Surface Temperature (°F)	Remarks
1. Beowawe	11 (1959-65)	Magma Power Co. & Associates	2,052	414	fumaroles, hot & geysersing springs to 205°	Hot water with 5-10% steam flashover. Problems of scaling and cold water inflow.
2. Brady's Hot Springs	9 (1959-65)	Magma Power Co. & Associates (7) Earth Energy, Inc.(2)	5,060	418	springs to 194°	Hot water with 5% steam flashover. Problem of scaling.
3. Darrough Hot Springs	1 (1962-63)	Magma Power Co. & Associates	812	265	springs to 198°	Very large flow hot water, little steam.
4. Monte Neva	1 (1965)	Magma Power Co. & Associates	402	190	springs to 193°	Hot water
5. Steamboat Hot Springs	about 40 (1920-70)	various (see White, 1968)	3,206	369	fumaroles, springs to 205°	Most wells drilled for purposes other than testing geothermal power potential. Hot water with 5-10% steam flashover.
6. Stillwater	1 (1964)	O'Neill Geothermal, Inc.	3,200	240	no springs or other surface features	Hot water and steam first encountered while drilling water wells; used to heat homes.
7. Wabuska	3 (1959)	Magma Power Co. & Associates	2,223	222	springs to 162°	Hot water
8. Hot Springs Point (Crescent Valley)	1 (1965)	Magma Power Co. & Associates	410	166	springs to 122°	Hot water
9. Fernley (Hazen)	1 (1962)	Magma Power Co. & Associates	750	270	hot springs	
10. Hind's Hot Springs	1 (1962)	U. S. Steel Corp.			springs to 144°	Hot water
11. The Needles (Pyramid Lake)	3 (1964)	Western Geothermal, Inc.	5,888	240	springs to 208°	Large flow hot water
12. Wally's Hot Springs	2 (1962)	U. S. Steel Corp.	1,268	181	springs to 160°	20 additional shallow holes drilled to determine heat flow pattern.

*Data mostly from Koenig (1970); does not include shallow wells drilled mainly to provide water for bathing and drinking, or to heat individual homes.

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I. INTRODUCTION

The earth is an immense reservoir of energy, but most of this energy is contained in the earth's core and mantle at depths unlikely ever to be tapped by any foreseeable drilling technology. Within the earth at depths potentially accessible to drilling (about 6 miles) are stored approximately 10^{24} British thermal units of heat (White, 1965, p.2), but most of this heat is far too diffuse to be considered as a potential resource. However, economically significant concentrations of geothermal energy do occur in local "hot spots" where high temperatures (150° to 650°F) are found in porous rocks containing liquid water and (or) steam; such concentrations of extractable heat are known as "geothermal reservoirs." The reservoirs are found in regions of recent volcanism and mountain-building and in the deep parts of many sedimentary basins.

The energy in a geothermal reservoir consists of heat, largely stored in rocks and to a lesser extent in liquid water and (or) steamfilling pores and fractures. The water and steam provide the means by which heat from deep sources is transferred by convection to depths shallow enough to be tapped by drilling. Water and steam also serve as the agents by which geothermal heat escapes at the surface in hot springs and fumaroles and through which geothermal heat can be tapped commercially by wells.

The fluid in most geothermal reservoirs is liquid water (White and others, 1971) that is held at temperatures above surface boiling by the confining pressure. Decrease in pressure upon withdrawal of the liquid water causes steam to form by boiling, and a mixture of steam and water is produced at the surface. A few reservoirs contain primarily steam, and the wells produce dry or superheated steam with no water. These dry steam reservoirs are positively known only in the Larderello-Mt. Amiata region of Italy and at The Geysers, Calif.

For a geothermal reservoir to have appreciable potential for exploitation, it must meet the following requirements: (1) relatively high temperature (greater than 150° to 400°F, depending on processing technology), (2) a depth shallow enough to permit drilling (currently 10,000 ft. or less), (3) sufficient rock permeability to allow the heat transfer agent (water and (or) steam) to flow continuously at a high rate, and (4) sufficient water recharge to maintain production over many years.

Limited exploitation of geothermal resources has occurred since the turn of the century, primarily to generate electric power. Geothermal resources also have been used for space heating, product processing, and agricultural heating, and in addition some geothermal fluids contain chemicals and metals that are potentially valuable byproducts.

On December 24, 1970, the President of the United States of America signed into law the Geothermal Steam Act. This legislation authorized the Secretary of the Interior to issue leases for the development and utilization of geothermal steam and associated geothermal resources. Pursuant to the national Environmental Policy Act of 1969, the Secretary prepared an Environmental assessment (Impact Statement) on the proposed program and alternatives. The draft document was released for public comment in October of 1971. After "Environmental Statement of the Geothermal Leasing Program" was released in October of 1973.

One of the major recommendations for the mitigation of possible adverse environmental impacts was to prepare an environmental assessment of the specific area proposed for leasing. The following Environmental Analysis Record is submitted in compliance with this recommendation. To identify possible mitigating measures relative to the specific geographic area under consideration.

Some decisions have been made within the planning systems of the US Forest Service (USFS) and Bureau of Land Management (BLM). Areas in which leasing is not acceptable and should not be permitted at this time, are identified and are not treated by this Environmental Analysis Record (EAR).

The decision not to lease these areas at this time is a result of apparent conflicts with data contained in the USFS Central Nevada Land Use Plans and the BLM Management Framework Plan (MFP) and Unit Resource Analysis (URA) which are the Surface Management Agencies Land Use Documents. At such time as these documents are updated to include this data excluded areas will be re-examined.

II. DESCRIPTION OF THE PROPOSED ACTION

Lease federally owned geothermal resources in the Tonopah Resource Area.

Four stages of implementation have been identified. It should be noted that under some conditions, the potential for overlap of various stages does exist.

A. Exploration includes all activities from the decision to explore for a geothermal field through the drilling of one or more large diameter deep exploaration borings which will have the potential to be used production or waste disposal wells. The discrete operations are:

1. Airborne exploration
2. Off-road vehicular travel
3. Road and trail construction
4. Drilling/seismographing
5. Rehabilitation

B. Development includes all activities after a determination that of a useable geothermal resource exists in the area up till such time as actual commercial production of power begins.

The discrete operations are:

1. Road construction and improvement
2. Drilling Operations
3. Plant construction and development
4. Electric transmission lines
5. Construction camp

C. Operations includes all activities after commercial production of power begins through the period that facilities are "on line" till such time as the site is no longer viable and abandonment begins. The discrete operations are:

1. Production
2. Maintenance
3. Waste Disposal
4. Expansion

D. Abandonment includes all activities that are related to removal of surface and subsurface equipment and reclamation and rehabilitation of the site. The discrete operations are:

1. Removal of physical plant
2. Surface reclamation and restoration

III. DESCRIPTION OF ALTERNATIVES

For a discussion of alternate energy sources and their impacts on the overall environment, see the discussion in Volume I of Final Environmental Statement for the Geothermal Leasing Program, USDI, 1973.

Some lands have been excluded from consideration in this EAR. The specific alternates identified for non-excluded lands are as follows:

Lease only those portions of the resource area upon which impacts will be minimal.

Lease only as may be required to honor grandfather rights (as defined in 43 USC 3230).

Do not allow leasing of any of the lands within the resource area.

IV. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non Living Components

1. Air

Analysis of the steam produced by the Darrough "steam" well is given in "The Chemical Composition and estimated Minimum Thermal Reservoir Temperatures of the Principle Hot Springs of Northern Nevada", USGS Open file Report, May, 1974.

To the writers knowledge no analysis has been made of gases emitted at any other thermal springs within the resource area. As all of the thermal springs are used extensively by livestock and wildlife there is not reason to believe that gases in quantities approaching toxic levels are emitted. Generally, a slight sulphurous odor may be expected in the vicinity of thermal springs.

For a discussion of tocicity levels, see Final Environmental Statement for the Geothermal Leasing Program, USDI, Volume I, Page 111-114 (1973).

a. Air Movement Patterns:

The prevailing surface winds are from the northwest. An occasional invasion of cold arctic air can bring northerly winds and extremely cold temperatures. The area is subject to winds of gale force throughout the year. Throughout the year, locally intense winds and large dust devils may pick up dry topsoil and sand to cause localized dust storms and lessen visibility. Visibility may be reduced to less than one half (1/2) mile under these conditions.

During the summer fire season air quality and visibility are often degraded by smoke produced by forest fires in California and carried in by the prevailing winds. Air inversion conditions can and do exist in the valleys. Air quality is generally good at present. There are air quality monitoring stations in Tonopah and Gabbs that have been established by the Nevada Air Pollution Commission.

b. Temperature variations are typical of those encountered in cold desert far removed from the tempering effects of large bodies of water. Recorded temperatures vary from a high of 112°F. (44°C) to a low of -20°F. (-29°C.). The elevation of the highest weather station in the resource are is 5,626 feet (1654m), and as elevations in excess of 10,000 feet (3030m) are encountered in the area, it can be expected that minimum temperatures as low as -45°F. (-43°C.) could be encountered during the winter months.

During both the summer and winter months, variations in temperature within a 24-hour period of 60°F. (34°C.) may be expected.

c. Particulate Matter:

No studies of suspended particulate matter have been made to date in this area. Dust, due to windstorms, is by far the predominant suspended particulate matter encountered. Areas adjoining mining and farming operations are particularly dusty at times.

d. Fumes and Noxious Gases:

Sulphur dioxide, hydrogen sulphide, and related products are released to the atmosphere by some of the hot springs. The quantities are considered to be insignificant. Release of methane at these sites is not known at present, but quantities, if any, are minute. No comprehensive data is available on the level of concentration, areal extent or persistence of carbon monoxide, hydrocarbons and nitrogen oxides. Small amounts of each are dispelled by vehicles traversing the area on US Highway 6, State Highways 8A, 2, 25, 82 and 89, the numerous county roads in the area; as well as those produced by machinery and vehicles used in ranching, farming, and mining operations. Pollutants contributed by aircraft are relatively insignificant in this area at present.

e. Airborne Radiological Contaminants:

Airborne radiological contaminants of significant proportions were released during the period of open air testing of nuclear devices by the AEC in the 1950's at the Nevada Test Site. These contaminants were noticed primarily in the eastern portion of the resource area. Monitoring, initially by the AEC, and more lately by the EPA indicate that radiation in the area has essentially returned to the "normal" level that occurred prior to testing of nuclear explosive.

f. Ionizing Radiation:

Essentially negligible (see "e" above).

g. NonIonizing Radiation:

Essentially negligible.

2. Land

a. Soil:

Soils in the Tonopah Resource Area are variable due to differences in combinations of environmental factors responsible for their formation.
The soil types that may be encountered in the resource area are:

GROUP A

Entisols - Areas dominated by soils on recent landscapes lacking or weakly developed.

Torrifluvents, wet 0 Torriorthents, 0 to 2% slopes -

This unit occurs on valley floors in most valleys, and consists of about 60 percent Torrifluvents, wet, 30 percent Torriorthents, and 10 percent inclusions. Torrifluvents, wet, are composed of nearly level, very deep, moderately well and somewhat poorly drained, stratified loamy soils that are salt and alkali-affected. Greasewood and saltgrass are the dominant vegetation.

Torriorthents soils consist of nearly level, very deep, well drained, loamy soils that are salt and alkali-affected. Greasewood is the dominant vegetation.

The inclusions are composed mainly of dry, sandy Torripsamments, wet, loamy Haplaquolls and strongly alkali-affected Natrargids.

Rock outcrop - Xeropsamments, 50 to 75 percent slopes -

This unit occurs north of Tonopah on Lone Mountain, and consists of about 45 percent Rock outcrop, 35 percent Xeropsamments, 50 to 75 percent slopes and 20 percent inclusions. Rock outcrop consists of exposures of barren granitic bedrock. It is essentially devoid of vegetation.

Xeropsamments, 50 to 75 percent slopes are composed of very shallow to moderately deep, sandy soils over granitic bedrock. Juniper, together with scattered pinion pine at the upper elevations, are the dominant vegetation.

The inclusions are composed mainly of shallow Cryopsamments that occur above 7,000 feet; very deep, sandy Torripsamments and shallow Durorthids, both of which occur at lower elevations along the margins.

Torripsamments - Torrifluvents, wet, 0 to 5 percent slopes -

This unit occurs in Fish Lake Valley, and consists of 45 percent Torripsamments, 40 percent Torrifluvents, wet, and 15 percent inclusions. Torripsamments are composed of nearly level and gently sloping, very deep well and somewhat excessively drained, sandy soils. Shadscale if the dominant vegetation.

Torrifluvents, wet, are composed of nearly level and gently sloping, very deep, moderately well and somewhat poorly drained, stratified loamy soils that are salt and alkali-affected. Greasewood and saltgrass are the dominant vegetation.

The inclusions are composed mainly of very deep, loamy Torriorthents, wet, loamy Haplaquolls and shallow, alkali-affected Nadurargids.

GROUP B

Aridisols - Areas dominated by light-colored surface horizons and one or more properties characteristic to soils of arid regions.

Camborthids - Nadurargids, gravelly, 0 to 4 percent slopes -

This unit occurs on low-lying alluvial fans and terraces adjacent to the valley floors in most valleys where the precipitation is about 6 inches. It consists of about 20 percent Nadurargids, gravelly, and 20 percent inclusions. Camborthids are composed of nearly level and gently sloping, very deep, well drained, loamy soils, some of which have weak silica-cementation. Shadscale is the dominant vegetation.

Nadurargids, gravelly, consist of nearly level and gently sloping, shallow, well drained, loamy soils over duripans. They are alkali-affected in their subsoils. Shadscale is the dominant vegetation.

The inclusions are composed mainly of very deep, well drained, loamy Torrifluvents; very deep, sandy Torripsamments; very deep, loamy Camborthids, gravelly; and very gravelly or stony Nadurargids.

Durargids, gravelly - Nadurargids, stony, 0 to 15% slopes -

This unit occurs on high-lying alluvial fans and terraces in most northern valleys where the precipitation is 8 inches or greater. It consists of about 50 percent Durargids, gravelly; 30 percent Nadurargids, stony, and 20 percent inclusions. Durargids, gravelly, are composed of nearly level to strongly sloping, well drained, moderately deep and shallow, loamy and clayey soils over duripans. Big sagebrush is the dominant vegetation.

Nadurargids, stony, consist of nearly level to strongly sloping, well drained, shallow, clayey soils over duripans that have alkali-affected subsoils. Big sagebrush is the dominant vegetation, but juniper may be of local importance along the upper boundaries.

The inclusions consist mainly of Haplargids, gravelly; Camborthids, gravelly; Durargids, stony; and Nadurargids, very stony or gravelly.

Camborthids, rocky, 15 to 50% slopes - Natrargids, very stony, 4 to 30% slopes -

This unit occurs in the mountains of the southern and western parts of the area. It consists of 60 percent Camborthids, rocky; 30 percent Natrargids, very stony, and 10 percent inclusions. Camborthids, rocky, sonsist of moderately steep and steep, well drained, shallow and moderately deep, stony loamy soils developed in residuum from bedrock. Twenty percent of these soils is made up of exposures of bedrock. Black sagebrush is the dominant vegetation, but big sagebrush or low sagebrush and juniper in combination with one of these plants may be of local importance.

Natrargids, very stony, consist of moderately sloping to moderately steep, well drained, moderately deep and deep, clayey soils that have alkali-affected subsoils. Black sagebrush is the dominant vegetation, but big sagebrush, or juniper in combination with either of these plants may be of local importance.

The inclusions consist of shallow, Xerorthents very gravelly, and gravelly loamy and gravelly clayey Haplargids, stony. The coarse fragment content of the surface layers preclude revegetation.

Durargids, gravelly - Durorthids, stony 4 to 30 percent slopes -

This unit occurs on high alluvial fans mainly in the northern part of the area where precipitation is greater than 8 inches. It is composed of 60 percent Durargids, gravelly, are composed of moderately sloping to moderately steep, well drained, moderately deep and shallow, clayey and loamy soils underlain by silica-hardpans. Big sagebrush is the dominant vegetation.

Durorthids, stony, consist of moderately sloping to moderately steep, well drained, moderately deep and shallow, very gravelly loamy and sandy soils underlain by silica-hardpans. Big sagebrush is the dominant vegetation.

The inclusions consist mainly of Durargids, stony; Camborthids, gravelly and stony; and Argizerolls, gravelly.

Nadurargids, gravelly - Nadurargids, very stony, 0 to 15 percent slopes -

This unit occurs on high alluvial fans and terraces mainly in the southern and western parts of the area where the precipitation averages about 6 inches. It is composed of 40 percent Nadurargids, gravelly; 40 percent Nadurargids, very stony, and 20 percent inclusions. Nadurargids, gravelly, are composed of nearly level to strongly sloping well drained, shallow, loamy soils underlain by silica-hardpans. They have alkali-affected subsoils. Shadscale is the dominant vegetation.

Nadurargids, very stony, are composed of nearly level to strongly sloping, well drained, shallow, clayey and loamy soils underlain by silica-hardpans. They have alkali-affected subsoils. Shadscale is the dominant vegetation.

The inclusions consist primarily of very deep sandy Torripsamments, very deep Torriorthents and shallow Durorthids, stony and gravelly.

GROUP C

Mollisols - Areas dominated by soils with dark-colored fertile surface horizons that have been formed under semi-arid to sub-humid climate.

Cryoborolls, rocky - Cryoborolls, stony, 30 to 75% slopes -

This unit occurs in the mountains, above 7,000 feet, of the central part of the area. It consists of about 50 percent Cryoborolls, stony; and 20 percent inclusions. Cryoborolls rocky, are composed of steep and very steep, shallow and very shallow, somewhat excessively drained, very gravelly, loamy soils over bedrock. Bedrock exposures comprise 20 percent of this area. Pinion pine is the dominant vegetation, but juniper may be locally important at the lower elevations.

Cryoborolls, stony, are composed of steep and very steep, moderately deep, well and somewhat excessively drained, gravelly and very gravelly, loamy soils over bedrock. Pinion pine is the dominant vegetation but big sagebrush and browse species are of local importance.

The inclusions consist mainly of shallow, sandy Cryopsammments; very stony and very rocky Cryoborolls and wet Cryaquolls.

Cryoborolls, very rocky - Cryoborolls, very stony, 30 to 75 percent slopes -

This unit occurs in the mountains, above 7,000 feet, of the central part of the area. It consists of about 50 percent Cryoborolls, very rocky; 30 percent Cryoborolls, very stony, and inclusions. Cryoborolls, very rocky, consist of steep and very steep, very shallow and shallow, somewhat excessively drained, very gravelly, loamy soils over bedrock. Bedrock exposures comprise about 40 percent of this area. Pinion pine is the dominant vegetation, but juniper may be locally important at the lower elevations.

Cryoborolls, very stony, are composed of steep and very steep, moderately deep, well drained, gravelly and very gravelly, loamy soils over bedrock. Pinion pine is the dominant vegetation, but big sagebrush and browse species are of local importance.

The inclusions consist mainly of stony and rocky Cryoborolls on lesser slopes and wet Cryaquolls.

Rendolls, very rocky - Cryoborolls, very stony, 30 to 50 percent slopes -

This unit occurs in mountains, above 7,000 feet, of the northeastern portion of the area where limestone is the domonant bedrock. It consists of about 50 percent Rendolls, very rocky; 30 percent Cryoborolls, very stony, and 20 percent inclusions. Rendolls, very rocky, consist of very steep, very shallow and shallow, somewhat excessively drained, very gravelly, loamy soils over limestone bedrock. Exposures of limestone bedrock comprise about 40 percent of the area. Pinion pine with an understory of black sagebrush and browse species are the dominant vegetation.

Cryoborolls, very stony, consist of steep, moderately deep, well drained, gravelly and very gravelly, loamy soils over bedrock. Pinion pine with an understory of black sagebrush and browse species are the dominant vegetation.

The inclusions consist mainly of similar soils on both lesser and steeper slopes and wet Cryaquolls.

Cryoborolls, stony, 4 to 30 percent slopes - Cryoborolls, gravelly, 2 to 15 percent slopes -

This mapping unit occurs in mountain valleys and divides, above 7,000 feet, in the northern portion of the area. It consists of about 60 percent Cryoborolls, stony; 30 percent Cryoborolls, gravelly, and 10 percent inclusions. Cryoborolls, stony, are composed of moderately sloping to moderately steep, moderately deep to very deep, well drained, loamy and clayey soils. Big sagebrush and browse species are the dominant vegetation.

Cryoborolls, gravelly, are composed of gently sloping to strongly sloping, moderately deep to very deep, well drained, loamy and clayey soils. Big sagebrush and browse species are the dominant vegetation.

The inclusions consist of more steeply sloping and very stony or very gravelly Cryoborolls and stony and very stony Natrargids and Haplargids.

Durixerolls, gravelly, 15 to 30 percent slopes - Argixerolls, stony, 30 to 50 percent slopes -

This unit occurs on high alluvial fans, terraces and foothills in the northern portion of the area. It consists of 50 percent inclusions. Durixorolls, gravelly, are composed of moderately steep, well drained, moderately deep and shallow, clayey and loamy soils over duripans. Big sagebrush is the dominant vegetation but low sagebrush is locally important.

Argixerolls, stony, are composed of steep, moderately deep and shallow, well drained, clayey and loamy soils over soft tuffs or hard bedrock. Big sagebrush and various browse species are the dominant vegetation.

The inclusions consist of less steeply sloping Durixerolls, gravelly; Durixerolls, stony, and less steeply sloping Argixerolls, gravelly.

GROUP D

Playas - Areas that are essentially barren, flat, generally dry, undrained basins. They may contain water of shallow depth for short periods at infrequent intervals. Many are salty.

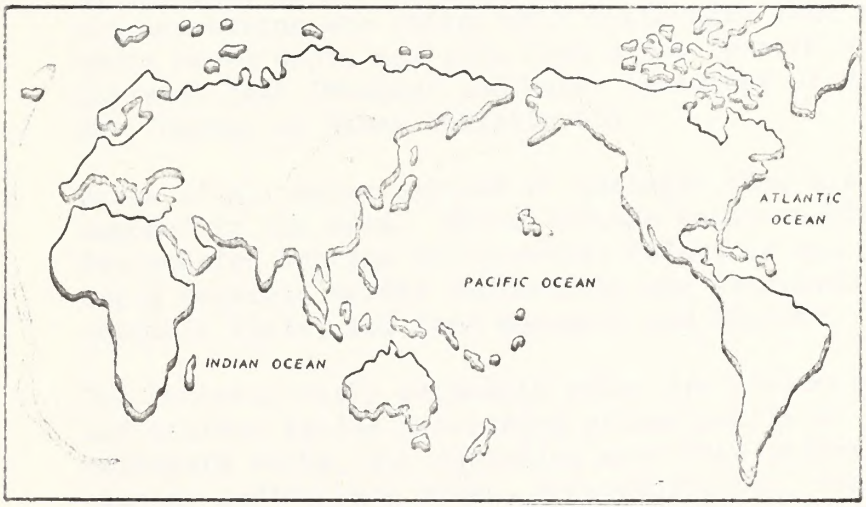


Fig. 1. Regions of intense geothermal manifestations; the distribution accords generally with recent volcanism and youthful mountain-building, and in part outlines boundaries of mobile crustal plates.

b. Geology

The physiography of the area is typical of the basin and range physiographic province (Fenneman, 1930), with alternating north-south trending mountain ranges and long narrow valleys. Playas occupy the lower portions of many of the valleys.

Geologic structures in Nevada are extremely complex. The western portion of the Tonopah Resource Area, (roughly west of the Monitor Range) lies under the upper plate of the Roberts Mountains Thrust, and subsequent deformation and erosion has resulted in localized removal of the plate exposing rocks of the lower plate in windows. The mountain ranges are generally fault block mountains that have been interpreted as horsts and tilted blocks. The intermontane basins are filled with Quaternary lake sediments whose depth may vary from a few feet to several thousand feet (Mineral and Water Resources of Nevada, Nev. Bureau of Mines Bulletin 65).

Rocks of all major periods of geologic time are exposed in the area. These include questionable Precambrian schists and granits; Paleozoic and early Mesozoic marine sedimentary and interbedded volcanic rocks; and late mesozoic and Cenzoic.

Two facies of early paleozoic rocks are present; and eastern facies consisting predominantly of carbonate rocks, but including some fine-grained clastic sedimentary rocks, orthoquartzites, and minor amounts of chert; and a western facies consisting of clastic sedimentary rocks, meta-volcanic rocks with varying amounts of interlayered meta-volcanic rocks. No late Jurassic or younger marine sedimentary rocks are known in Nevada. Known Cretaceous rocks are lake sediments, principally shale, graywacke, and conglomerate.

Thick volcanic sequences and interbedded lake sediments of Tertiary age cover much of Nevada. Early Tertiary volcanic rocks are in most areas, unconformably overlain by volcanic rocks of late Miocene and early Pliocene age which in part, inter-tongue with, and in part underlie, extensive early Pliocene lake sediments. These fresh water sediments include marl, tuff, diatomite, shale, sandstone, and conglomerate. They are overlain by volcanic rocks of late Pliocene and early Quaternary age.

Granitoid rocks are common throughout most of this area. They range in composition from alaskite to gabbro, but quartz monzonite and granodiorite are most abundant. Two periods of intrusive activity seem to be represented. The most widespread period started in the late Mesozoic and continued into the very early Tertiary (Lindgren, 1915); the intrusions are progressively younger from west to east. Rocks of the second period of intrusion are of probable late Oligocene or early Miocene age.

The Basin and Range physiographic province is an area of high heat flow, believed to result from near melting conditions in the lower crust and upper mantle.

The west-central and north-central areas of Nevada have higher hot spring temperatures (Koenig, 1970) and are regions of greater than normal heat flow. An area of conspicuously higher heat flow, called the "Battle Mountain High", is located in north-central Nevada.

The Battle Mountain High has an indicated average heat flow of about three heat flow units (two heat flow units are about average for Nevada), but the thermal gradients, which range from 30° to 60°C/km (about 2.6-4.3°F/100ft.) are not as high as might be expected, because of relatively high thermal conductivities of the rocks in this area (White, 1973). The Battle Mountain High may be the result of fairly recent intrusion of magma into the earth's crust. The Quaternary volcanism within the region suggests that this view is reasonable (Sass and others, 1971).

In many areas of the world, hot springs and other high-temperature phenomena such as fumoroles are associated with geologically young igneous rocks, commonly less than 5 million years old. Young volcanic rocks or active volcanoes at the earth's surface often indicate that hotter bodies of rock or fluid magma, are present below, in the upper part of the earth's crust.

Nevada lies in the center of a large province of Cenozoic volcanic rocks. Although many of these rocks are 10 to 30 million years old, younger volcanic rocks are found in many areas.

Many of the numerous hot springs occur along major faults which bound the mountain ranges. The basin-and-range pattern of linear, north-south-trending mountain and valley blocks is a result of these faults. The ground water in the valleys often circulates to considerable depths along some of these fractures, and is heated by the hotter rocks found at these depths.

If one knows the approximate geothermal gradient, the depth of circulation of ground water can often be estimated from water temperatures of springs (assuming little cooling has taken place as water ascends to the surface). The ground water under many of the valleys is measured in the millions of acre feet per basin. (Hydrologic Atlas of Nevada, Nevada Bureau of Mines).

The chemical composition of thermal spring waters can be used to estimate thermal-aquifer temperatures. Qualitative geochemical indicators include calcium and bicarbonate contents of near-neutral waters (Ellis, 1970); magnesium or magnesium to calcium ratios, low values indicate high thermal-aquifer temperatures (White, 1970); sodium to calcium ratios, high ratios may indicate high temperatures (Mahon, 1970), chloride to total carbonate ratios, highest ratios in related waters indicate the highest subsurface temperatures (Fournier and Truesdell, 1970); and chloride to fluoride ratios, high ratios may indicate high temperature (Mahon, 1970). Quantitative estimates of thermal-aquifer temperatures may be obtained from geothermometers based on silica and sodium to potassium (Na/K) ratios or sodium-potassium-calcium (Na-K-Ca) (Fournier and Rowe, 1966; White, 1965; Fournier and Truesdell, 1973). The basic assumptions in using quantitative geothermometers have been enumorated by Fournier, White, and Truesdell (1974) as follows:

1. Temperature dependent reations occur at depth.
2. There is an adequate supply of the constituents that are used as a basis for geothermometry.
3. Water-rock equilibrium occurs at the reservoir-temperature.
4. There is negligible re-equilibrium at the lower temperatures as the water flows from the reservoir to the surface.
5. There is no dilution or mixing of the hot water coming from depth with shallow water.

The silica geothermometer is based on the solubility of quartz (Fournier and Rowe, 1966). The cation geothermometers are based on exchange reactions between silicates and the aqueous phase (White, 1965; Ellis, 1970; Fournier and Truesdell, 1973). Fournier and Truesdell (1973) have shown that data for most geothermal waters cluster near a straight line when the function log (Na/K) + B log (Ca/Na) is plotted versus the reciprocal of absolute temperature. Beta (B) is 4/3 for solutions that have equilibrated below 100°C and 1/3 for solutions that have equilibrated above 100°C. The Na/K geothermometer should be used only for near-neutral and alkaline waters that do not deposit travertine and have Ca/Na of one or less (Fournier and Truesdell, 1973).

Fournier, White, and Truesdell (1974) present a set of guidelines for determining which subsurface-temperature estimate may best indicate the thermal-aquifer temperature. These authors recommend a procedure based on the temperature and discharge of the spring. A large discharge is taken to be 100 lpm (liters per minute) or more, whereas, a small discharge is less than about 20 lpm. Boiling springs having large dischargs may be considered to have colled adiabatically, whereas boiling springs having small discharges may have cooled by conduction. Boiling springs discharging between 20 and 100 lpm are in a range where the selection of the adiabatic or conductive silicat estimate of subsurface temperature becomes subjective.

Later discharge springs with temperatures below boiling may be either a mixed water or water which has equilibrated with rock only slightly hotter than the measured spring temperature. The mixed waters are produced by the mixing of high temperature (100°C) water and cold meteoric water. If the Na-K-Ca geothermometer indicates a temperature of more than 25°C above the measured spring temperature, then the water should be treated as a mixed water by the method of Fournier and Truesdell (1974). Estimated equilibrium temperatures for low discharge springs with temperatures below boiling are difficult to interpret. The discharge may be either a mixed water or water which has colled by conduction.

Only in the last decade have serious attempts been made to exploit the geothermal resource in the United States. Exploratory drilling took place in several areas in Nevada between 1959 and 1965. Although the majority of these borings were less than 1,000 feet (300M) in depth, temperatures of 300 to 400°F. (150 to 200°C.) were encountered.

The cessation of exploratory drilling in the mid-1960's was due in large part to the problems of leasing on federal land. The geohtermal resources appear to be mainly in hot water systems rather than dry steam, and interest in this type of field was low in the early part of the 1960's.

Today, with changes in energy supply and investment attitudes, and the advance of low temperature power generation technology, exploration is once again being carried on for geothermal power. Union Oil Company has drilled, and is testing a geothermal well on private land within the Brady-Hazen KGRA (Known Geothermal Resource Area) adjacent to National Resource Lands (NRL) leased by them in the fall of 1974.

U.S. Energy Balance, 1970–85, from Domestic Sources
(In conventional physical units)

Energy source	1970	1975	1980	1985
Projected Domestic Supply				
Oil (millions of barrels per day)				
Conventional	11.3	11.1	11.8	11.1
Synthetic (from shale)	—	—	—	0.1
TOTAL	11.3	11.1	11.8	11.2
Gas (trillions of cubic feet)				
Conventional	21.82	19.80	17.47	14.50
Synthetic	—	0.37	0.55	0.91
TOTAL	21.82	20.17	18.02	15.41
Coal (millions of short tons)				
For domestic use	519	651	799	933
For export	71	92	111	138
TOTAL	590	743	910	1,071
Other (billions of kilowatt-hours)				
Hydroelectric	249	271	296	316
Nuclear	23	326	926	2,067
Geothermal	0.7	12	34	51
TOTAL	272.7	609	1,256	2,434
Imports Required to Balance				
Oil (millions of barrels per day)	3.4	7.3	10.7	14.8
Gas (trillions of cubic feet)	0.92	1.55	3.75	6.08

SOURCE: National Petroleum Council, "U.S. Energy Outlook: An Interim Report," November 1971.

It may be expected that activity will resume in some of the now inactive mining districts, and with the advance in exploration techniques new discoveries will be made.

Major production of Barite ($BaSO_4$), a mineral vied as a weighting agent in oil field and geothermal drilling muds, and as a source of Barium chemicals is taking place in Northumberland Canyon in the Toquima Range.

Barite prospects have been noted at Warm Springs and other areas though as of this date production has been minimal.

Other minerals that have been (and some currently are) produced in the Resource Area are Antimony, Arsenic, Iron, Mercury, Lead, Zinc, Tungsten, Diatomite, Flourspar, and Turquoise.

Minerals of Beryllium, Cobalt, Nickel, Lithium, Manganese, Beryllium, Copper, Rhenium, Selenium, Vanadium and Uranium are known to exist in the Resource Area. Production has been insignificant in the past, but the potential for commercial production does exist dependent upon sufficient demand and adequate price.

Platinum has been found associated with gold and silver, but there has been no significant production.

Some dimension stone has been produced, and sand and gravel are in good supply throughout most of the area.

c. Land Use Suitability and Compatibility

Existing land uses are reasonably compatible with adjacent lands. The principle activities in the area are mining and livestock grazing.

There are small areas of irrigated farming.

Primitive values are varied. One area is under consideration for a primitive area. Studies of this area (Morey Peak) are in an early stage at present, and are not expected to be completed in the near future.

Morey Peak is the sole area on National Resource Lands (NRL) currently under consideration for a primitive area.

The Arc Dome Candidate Wilderness Area is on land administered by the USFS on the southern end of the Toiyabe Range. Studies are tentatively scheduled in this area in 1981.

A Research Natural Area is on land administered by the USFS in the central part of the Monitor Range, and several areas are designated as roadless areas.

A unit of the State Park System is located at the stabilized "ghost town" of Berlin-Icthyosaur State Park in Ione Valley, and their are USFS campgrounds at Cherry Creek, Big Creek, Bob Scott Summit, Icthyosaur Paleontologial Monument, Kingston, Peavine, and Pine Creek.

The Fremont Route of 1845 crosses a portion of the area, no visible traces remain.

Crescent Dunes is used by ORV groups for competitive events and also is used to a limited extent by local residents.

As with all mineralized areas, rockhounds and other mineral hobbyists frequent the area. Normally their visits are limited to those areas that have been disturbed by mining activities in the past.

Lunar Crater has been identified on the National Registry of National Landmarks, and an area surrounding it has been withdrawn from entry.

Pinion nuts are collected by both Indians and non-indians in the mountainous areas containing pinion.

The resource area is traversed by US Highway 6, State Highways 8A, 82, 89, 25, numerous county roads, and trails resultant from prospecting and mining.

Scars on the hillsides bear evidence of mining activity, both past and present which place no value upon aesthetic and surface uses not directly related to mining.

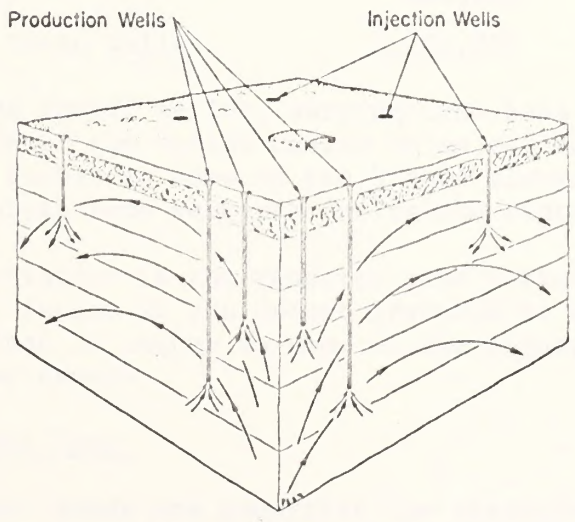
Future land uses are affected by existing zoning and environmental regulations.

3. Water

a. Hydrologic cycle

The Tonopah Resource Area lies completely within Nye County, Nevada. Some portions of the Toiyabe National Forest being considered in this EAR lie within the southern portions of Eureka and Lander Counties.

The only perennial streams to be found within the resource area are short ones that begin in the mountainous areas and die in the arid lowland basins. There are innumerable small springs throughout the area that are important (and in many areas critical) sources of water for wildlife and livestock. Numerous thermal springs are scattered throughout the resource area. A tabulation of known thermal springs is enclosed as part of this document. It is known that some thermal springs in the area have not been described in the literature to date.



Geothermal reservoir (schematic).

Water produced by the springs (thermal and non-thermal) in the area is of satisfactory quality for wildlife and livestock. Many of the springs on public lands have been appropriated under state water law by livestock operators and other agriculture interests.

The hydrologic atlas of Nevada indicates that major significant ground water reservoirs are located beneath Big Smoky Valley, and Hot Creek Valley. Lesser, but still significant ground water reservoirs are located in the alluvial valley fill in Little Fish Lake Valley, Monitor Valley, Ralston Valley, Stone Cabin Valley and Willow Creek Basin.

Examples of estimated storage, perennial yield of runoff in some of basins in the resource area are:

Basin Name	Storage (Acre/feet)	Per. Yield (Acre/Feet)
Big Smoky Valley	5,000,000	65,000
Hot Creek Valley	2,300,000	6,000
Railroad Valley	6,000,000	---
Little Fish Lake Valley	200,000	10,000
Stone Cabin Valley	2,200,000	2,000

Average runoff is low, varying from less than 1 inch in most of the valley basins to an estimated maximum of 10 inches in some of the higher elevations that accumulate some snowpack during the winter months.

Precipitation in the resource area varies from less than 5 inches in the desert lowlands to slightly more than 12 inches in some of the higher pinion-juniper areas.

b. Sediment Load

Sediment loads are generally low throughout most of the year. The area, as is typical of all desert areas, is subject to flash flooding in all water-courses, perennial and intermittent. During flash flooding, sediment loads can be high. Little quantitative data is available on sediment loads.

c. Dissolved Solids

Little quantitative data is available on dissolved solids in water throughout the area. The Hydrologic Atlas of Nevada (Nevada Division of Water Resources, 1971) indicates that less than 1000 ppm of dissolved solids is likely throughout the area in spring and well water. The water presently being emitted at hot springs throughout the area is suitable for and is commonly used for watering livestock.

d. Chemicals, Heavy Metals and Toxic Substances

No known data available.

e. Nutrients, Solid Debris, Coliform Contaminants

No known data available, though coliform contamination and nutrients can be expected to be high as a result of livestock usage in many areas.

f. Acid Balance (ph)

Not known at present. Laboratory determinations by USGS and AEC are being done at present for the geothermal waters.

g. Dissolved Oxygen

No known information on ground water.

h. Temperature

Temperatures at some of the thermal springs in the area are tabulated below:

Site	Spring Temperature
Darrough Hot Springs	207°F. (97°C.)
Darrough "Steam Well"	265°F. (129°C.)
Fish Springs	60°F. (16°C.)
Warm Spring in Little Fish Lake Valley	105°F. (41°C.)
Spring near Warm Springs	142°F. (61°C.)
Spring (unamed) in T.4N.,R50E.	Boiling
Blue Eagle Springs	82°F. (28°C.)
Charnock Springs	80°F. (27°C.)
Indian Springs	Warm
Spencer Hot Springs	144°F. (62°C.)

It should be noted that several of the borings drilled by the US AEC in conjunction with Operation Faultless produced thermal waters.

B. Living Components

1. Terrestrial Plants

The major vegetation types are grass, sagebrush, greasewood, saltbrush, and pinion-juniper.

The vegetation can be divided into the following types by elevation and dominant species without too much overlap.

Flatland- Greasewood type (4500 to 5000 feet) - This type is mainly found on the valley floors and varies from pure stands of greasewood to mixtures of greasewood, shadscale, rabbitbrush, big sage. The understory is composed of great basin wild rye, alkali sacaton, squirreltail and cheatgrass. The major forbs are peppergrass, halogeton, Russian Thistle and mustard. The "original" appearance of this type was probably less greasewood, rabbitbrush, big sage, shadscale and more perennial bunch grasses. Early survey records show that meadows existed along the water courses, but these sites are now supporting brush species.

Another flatland type would be the winterfat type. This type is also mainly found along the valley floors and varies from pure stands of winterfat to mixtures including shadscale, rabbitbrush, and blacksage. The understory is composed mainly of squirreltail, galleta, Indian ricegrass, and cheatgrass. The climax plant community of this type is thought to be predominantly winterfat.

Shadscale type (5,000 to 5,300 feet) - This type is located mainly on the benches and low foothills and consist of shadscale, sage, rabbitbrush, budsage, hop sage, with an understory of squirreltail, cheatgrass, galleta and Indian ricegrass. Some of the forbs in the understory are wild mustard, halogeton and primrose.

This shadscale type has projections of the next higher type (big sage) in the more favorable moisture locations such as along draws and washes. The original condition of this type is not known, but there is evidence that bud sage and cheatgrass have invaded at the expense of winter fat and perennial grasses.

Big Sage Type (5,000 to 10,000 feet) - This type takes in most of the foothills and mountains in the unit with the exception of scattered pinion-juniper and perennial grass types. Big sage, black sage and small amounts of rabbitbrush, service berry, snowberry, mountain mahogany make up the shrub cover. Giant wild rye, cheatgrass, needle and thread, galleta, Indian ricegrass, and squirreltail make up a large portion of the understory.

Important forbs are lupine, filaree and buckwheat. It is not known what this type originally looked like, but there was probably a greater amount of perennial grass than at present.

Pinion-Juniper Type (6,000 to 8,000 feet) - This type is found in localized areas throughout the unit, and a major portion of the lands under Forest Service administration is of this type.

Big sage and rabbitbrush are intermixed with pinion pine and juniper. Sandberg bluegrass, needlegrass, and cheatgrass are the most common grasses found within this type. The ground cover density in some of these areas is extremely low due to erosion and lack of suitable growing conditions and tree canopy density.

Creek Bottom Type (variable elevations) - This type exists because of favorable growing conditions. The creek bottoms are dominated by a dense stand of willow, chokeberry, cottonwood and at the higher elevations, aspen.

Perennial Grass Type (8,000 feet) - There are isolated areas which are mainly perennial grasses and grasslike plants (rushes-sedges). High mountain meadows and spring aprons make up most of these areas. They are extremely important to both livestock and wildlife.

Poisonous plants are found throughout the unit, but no major livestock losses are known to have occurred because of them. Lark-spur, loco weed, halogeton, death camas and chokecherry are some of the poisonous plants.

2. Aquatic Plants

Two factors are involved which regulate the species and kind of plants which can and do grow near hot springs and related cold water springs: (1) the ability to withstand extreme and unrelenting grazing pressure, and (2) the ability to tolerate saline and/or alkaline soil and water. Because these water sources are often the only surface water within several miles (commonly up to five miles) both wildlife and livestock use them heavily. Livestock use is dominant, creating a barnyard type, environment in the immediate vicinity of the spring. In the Tonopah Resource Area, salt grass (Distichlis stricta) is the dominant species in these areas. In some cases the water is either too hot or too mineralized to support any kind of higher vegetation at the water source. Higher forms of plant life occur away from the water sources where the water temperature and/or mineral content is reduced to a tolerable level. In springs with relatively low water temperatures and low mineral content, cattail (Typha) and bullrushes (Juncus) and sedges (Carex) are present if the area is large enough and wet enough to prevent their being grazed. In all instances, with increasing distance from the water source and consequent decrease in grazing and trampling and reduced irrigation, vegetation gradually reverts to the flatland greasewood type described above.

3. Animals (Terrestrial and Aquatic)

Cattle are the most important animals economically within the Resource Area. BLM and USFS authorize livestock grazing yearlong throughout most of the Resource Area on federal lands. Cattle are the dominant species licensed. Sheep grazing is generally confined to spring, fall, and winter. Only cattle and horses use hot spring areas intensely. Wild Horses are common throughout the Resource Area. Animals of economic importance include mule deer, sagegrouse, chukar partridge, antelope, coyotes, and wild horses. Other animals which are conspicuous within the area are Golden Eagles, various species of hawks, desert bighorn sheep, badgers, various rodents, ravens and blacktailed jackrabbits. Significant populations of mountain lions exist in the various mountain ranges within the Resource Area. Fishable populations of trout exist in several of

the smaller streams. Waterfowl are important and conspicuous in Railroad Valley, and in other areas where suitable habitat exists.

Prairie falcons, one considered a rare and endangered species, are becoming common over certain parts of the Resource Area. For a complete list of vertebrate wild animals found in the Tonopah Resource Area refer to Attachment I.

BLM and USFS maintain within their planning systems comprehensive data on animal and animal habitat, the Nevada Department of Fish and Game also provided inputs to this report by contributing a publication by the Nevada State Engineers Office, Volume Number 6; "Water for Nevada - Forecast for the Future - Fish and Wildlife." This publication identifies and describes animal habitat throughout the state for both game and non-game species. All the above mentioned references are hereby included as reference. The latter is readily available at most libraries within the state, and the former documents are available at Bureau of Land Management and U.S. Forest Service Offices within the state.

There are lands within the Resource Area that are identified as "crucial" habitat for a variety of different animal species, such as mule deer, sage grouse, all water fowl species, prairie falcons, and most trout species. These areas include such areas as sage grouse strutting grounds, limited summer or winter range for mule deer, and water areas which are a necessity for the survival of all waterfowl species and all fish species, and steep rocky cliffs as nesting sites for falcons. The majority, but certainly not all of these sites are identified in Appendix B.

Also many species of invertebrates undoubtly occur throughout the Resource Area, such as, insects, mollusks, spiders, ticks, beetles, and worms. To the writer's knowledge no known inventory exist for these species.

4. Ecological Relationships

Man's influence, direct and indirect, is responsible to a significant degree for the present environment as it exists in the Tonopah Resource Area.

Ecological interrelationships in this area and have been greatly influenced by livestock grazing since its introduction into the area on a large scale in the middle 1800's. Except where livestock have been excluded for whatever reason, the influence of grazing is and has been the major cause of ecological change over this geographical area. Areas of livestock exclusion are few and generally of small area.

Relationships which exist within such processes as energy flow, hydrologic cycle, and nutrient cycles continue to exist though specific components may change as alterations of the environment occur.

Available moisture and temperature are cirtical factors influencing life directly and indirectly. The period of optimum energy for plant growth lacks adequate soil moisture. This limits plant growth which in turn restricts the habitat for animals dependent upon plants for food and cover. This food-cover-habitat relationship is particularly evident around springs and other perennial water sources. It is discussed later under this section.

Ecosystems of the planning unit, both aquatic or terrestrial, are very complex. The most diverse populations of wildlife with the most complex inter-relationships occur where water is available.

There are four basic levels of energy and nutrient consumption-production: (1) nutrient sources, (2) nutrient producers, (3) nutrient consumers, and (4) decomposers. (See Attachments)

Energy is transferred form one level to the next by the plants using water, minerals and sunlight to grow; by animals eating the plants; and by animals eating animals. The amount of energy transferred decreases from one level to the next as each level uses energy for growth and respiration. The energy used is not transferred, but lost to the next level.

Plants, insects, animals, birds all return to the energy source through the decomposers. All levels will return waste and dead organic matter to the land. Decomposers (bugs, worms, larvae) break down the dead matter into simple substances. This is then returned to the energy source and made available for reuse. Each plant, plant eater, or meat eater is dependent upon the energy level preceding it for the special food, water, and cover required by each species. The removal of any component (insect, plant, or animal) results in the loss (to the next level) of the energy contained in that organism. As a result, a population may diminish through a decrease in food supply.

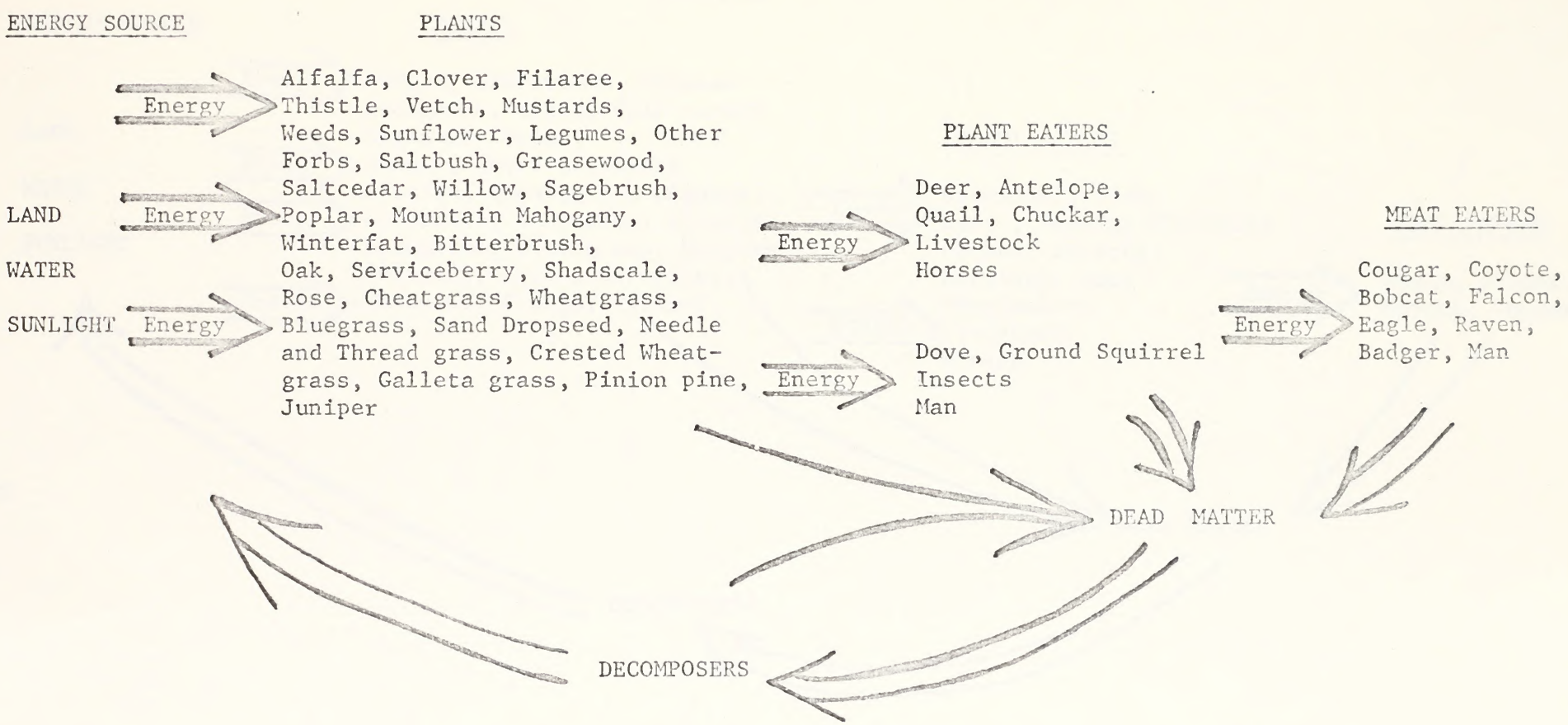
The ecosystem can be altered by removal of vegetation or rock ledges. The affected areas become uninhabitable to existing species so other plants, animals, etc., move into the area to replace them. The replacement population is desirable or undesirable depending upon the value placed upon the existing situation. Therefore, surface disturbance can obliterate historic sites, decrease environmental qualities, and advance or retard natural succession by many thousands of years.

Water moves through an ecosystem in a different way from minerals. This movement of water from the ocean to atmosphere to land and back to the oceans is known as the hydrologic cycle. Water which reaches the soil may pass through and leave the ecosystem by way of springs, streams or underground channels.

Any surface disturbance effects the hydrologic cycle. Runoff from these areas will cause eroded materials to run into the lakes and streams. Gases emitted into the atmosphere may eventually be carried through the hydrologic cycle. Thus, there is a constant flow of energy, water and chemicals through any ecosystem. As long as input balances output, the system remains stable, if losses exceed the input, as so often occurs when man interferes with the natural scene, then the system breaks down; the community is replaced by one of a differnt kind; or in severe cases, is completely destroyed.

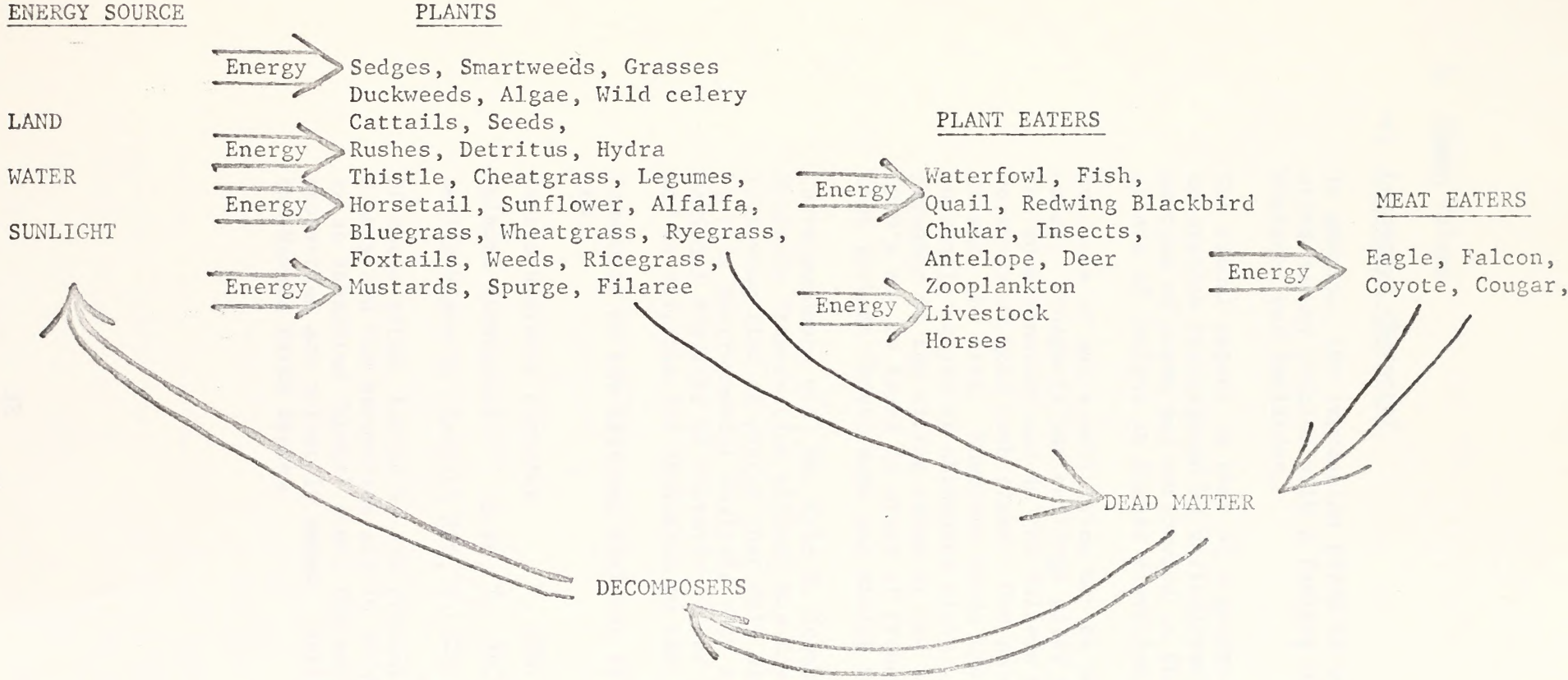
TERRESTRIAL - ECOLOGICAL INTERRELATIONSHIPS

CHART 1


ENERGY SOURCE
PLANTS
Energy
Alfalfa, Clover, Filaree, Thistle, Vetch, Mustards, Weeds, Sunflower, Legumes, Other Forbs, Saltbush, Greasewood, Saltcedar, Willow, Sagebrush, Poplar, Mountain Mahogany, Winterfat, Bitterbrush, Oak, Serviceberry, Shadscale, Rose, Cheatgrass, Wheatgrass, Bluegrass, Sand Dropseed, Needle and Thread grass, Crested Wheatgrass, Galleta grass, Pinion pine, Juniper
LAND
WATER
SUNLIGHT
Energy
Energy
PLANT EATERS
Deer, Antelope, Quail, Chuckar, Livestock Horses
Energy
Dove, Ground Squirrel Insects Man
Energy
MEAT EATERS
Cougar, Coyote, Bobcat, Falcon, Eagle, Raven, Badger, Man
DEAD MATTER
DECOMPOSERS

AQUATIC - ECOLOGICAL INTERRELATIONSHIPS

CHART 2



5. Human Values

a. Landscape Character

In general, the impression given is one of bold stark beauty coupled with a feeling of extreme distance and isolation.

The visual aspect is that of a generally drab coloration highlighted by varicolored rock outcrops, patches of aspen and cottonwood in the canyons and stands of juniper at higher elevations.

Evidence of man's activities may be noted in many areas. Prospects and tailings piles may be seen on the mountainsides and in the valleys marking the workings of gold rush times. One major power line crosses the area. Numerous roads and trails connect currently active or abandoned mines. The dwindling remnants of the mining camps of the 1800's and early 1900's may be found in areas of pronounced mineralization (Nevada Ghost Towns and Mining Camps, Paher, 1970).

Correspondence with Mr. Eric R. Cronkhite, Nevada State Historic Preservation officer has developed the following list of places that fall within the area treated by this Environmental Analysis that are on the National Register of Historic Places or which may be eligible for inclusion on the Register.

Presently on the National Register of Historic Places are:

Austin Historic District	T. 19N., R. 43E.
Belmont (townsite)	S.26, T. 9N., R. 45E.
Berlin Historic District	S29, T. 12N., R. 30E.

Of these sites, Austin is the present seat of Lander County and the properties are in private hands. Belmont is an inhabited "ghost" town, the majority of the properties are privately owned. Berlin is a unit of the Nevada Parks System.

Nominees for the National Register of Historic Places are:

Tybo (townsite)	S½13, N½24, T.6N.,R.49½E.
Tybo Charcoal Ovens	NW¼NW¼23, T.6N.,R.49E.
James Wild Horse Trap	S23, T.11N.,R.50E.
Ione (townsite)	S34, T.13N.,R.39E.

Potential sites for Nomination to the National Register of Historic Places:

Antelope Spring (spring)	S.31, T. 12N., R. 33E.
Arrowhead (Ghost town)	T. 2N., R. 51E.
Atwood (Ghost Town)	T. 11N., R. 36E.
Barcelona (Ghost Town)	S.6, T. 9N., R. 45E.
Baxter Springs (Ghost Town)	S.26, T. 7N., R. 43E.
Bellehelen (Ghost Town)	S.12, T. 2N., R. 49E.
Clifford (Ghost Town)	S.3, T. 3N., R. 49E.
Danville (Ghost Town)	S.24, T. 11N., R. 48E.
Ellsworth (Ghost Town)	S.19, T. 13N., R. 37E.
Goldyke (Ghost Town)	S.15, T. 10N., R. 36E.
Grantsville (Ghost Town)	S.3, T. 11N., R. 39E.
Hannapah (Ghost Town)	S.10, T. 3N., R. 45E.
Hot Creek (Ghost Town)	S.17, T. 8N., R. 50E.
Jefferson (Ghost Town)	S.18, T. 10N., R. 45E.
Kingston (Ghost Town)	T. 16N., R. 43E
Manhattan (Ghost Town)	S.20, T. 8N., R. 44E.
Morey (Ghost Town)	S. 5, T. 9N., R. 51E.
Northumberland (Ghost Town)	S.14, T. 12N., R. 45E.
Ophir (Ghost Town)	S.32, T. 13N., R. 42E.
Phonolite (Ghost Town)	T. 14N., R. 38E.
Reveille (Ghost Town)	E½12,13 T.2N., R. 51½E.
Round Mountain (Active Mining Camp)	S.21, T. 10N., R. 44E.
San Antonio (Ghost Town)	S.18, T. 7N., R. 42E.
Silverbow (Ghost Town)	S.33, T. 1N., R. 49E.
Tonopah (Live Town)	T. 2&3N., R. 42E.
Washington (Ghost Town)	T. 15N., R. 42E.
Simpson Wagon Rd.	S.7-18, T. 19N., R. 44E; 7, 17-22, 27-30 T. 19N., R. 45E.

Of the potential sites, Manhattan and Round Mountain are active mining camps with activity increasing every day as would be expected in view of the current high price of gold and silver. Tonopah is the county seat of Nye County, a lively community of 2,500 people. The remainder of the named town sites are relict mining camps. The remnants upon the sites vary from negligible to significant. A large portion of the lands involved are in private ownership, having passed into private hands either as patented mining claims and mill sites, or as town sites.

It is believed by this writer that geothermal leasing will have no effect on the historical values in Austin, Tonopah, Round Mountain and Manhattan as these are currently viable communities, with active mining programs and other developments in full swing in and surrounding them. Summa Corporation is currently the owner of and working many of the properties at Manhattan and Tonopah and a Canadian owned consortium is presently developing the properties at Round Mountain.

Seasonal changes in vegetation provide brief periods of locally brilliant coloration.

Away from inhabited areas the noise levels are low.

b. Sociocultural Interest

(1) Education/Scientific: The areas around hot springs can contribute to scientific and historical knowledge as well as add to the general understanding of natural processes and ecological interrelationships.

Hot springs are of current interest in the search for alternate sources of power in that they are surface manifestations of geothermal activity. In this capacity, they are indicative of general areas which might yield subterranean hot water or steam in quantities adequate for power generation or for application to industrial processes.

Natural phenomena associated with hot springs can also be of scientific interest. Unusual microorganisms specially adapted to the environmental conditions around hot springs have been used in scientific research. In certain areas, mineral compounds have been deposited on and around roots or plants. Long after the plant has died,

the calcified matrix remains. Mounds of these "skeletons" closely resembling piles of bones can be found near hot spots. Bubbling mud pots, sometimes transitory in nature, can often be found in hot springs areas. Another interesting feature related to hot springs in that they are often associated with geological fault zones.

Hot spring areas are also logical sites for historical and archaeological resources. Many of the springs (Spencer Hot Springs and Darrough Hot Springs) in the area have been developed in the recent historic past as spas where the thermal waters have been valued for their curative powers. It is reasonable to assume, based on the evidence at hand, that the aboriginal inhabitants of the area valued the waters similarly and made heavy use of them and the surrounding areas.

There are archaeological resources in the area. Wherever water is to be found in the desert archaeological sites are also to be found. This is a general rule that applies not only to "live" waters, but also to "extinct" water resources such as springs that have gone dry on Pleistocene lake beds. This rule applies as much to hot and warm water resources as it does to cold water.

Spring deposits have value for paleontological dating in that they are often repositories of pollen.

(2) Cultural Values:

The Shoshone and Piute Indians traditionally have gathered pinion nuts in the areas that support pinion pine.

(3) Social Welfare:

The study area lies principally in Nye County with some of the national forest lands extending north into Lander and Eureka Counties. The counties are governed by boards of county commissioners. A major concern to the commissioners would be the impact of development on community services.

There are several towns in the study area. Tonopah, the seat of Nye County, has a population of 1,716 (1970 census). Round Mountain, in Big Smoky Valley has a population of approximately 100 at present, but may show an increase if the price of gold remains high and mining activity increases. Manhattan, in Big Smoky Valley, south of Round Mountain, was once a thriving mining camp of 4,000 souls. At present, it has a stable population of approximately 100 persons. Interest is being shown in reopening the mines and if the price of gold remains high, the possibilities of future population increases are good. A small area of relatively high population density is centered on Carver's Station, approximately 14 miles north of Round Mountain. Belmont, formerly the county seat of Nye County, an inhabitated "ghost town" in the area has a year round population of approximately 10 persons. Ione, also at one time the county seat of Nye County, and another inhabitated "ghost town" has a year round population less than 30 people. The rural areas are sparsely populated. Therefore, the flow of goods and services in the area is minimal. Present activities consist primarily of agriculture (grazing) and mining.

The population of Tonopah is heavily dependent upon governmental agencies and entities for employment.

(4) Attitudes and Expectations:

It is to be expected that the citizens of any area surrounding a geothermal site would be well aware of its existence.

Long established residents may have reservations about development, but a majority of present residents would probably welcome development.

Unemployment is lower than the national average in the Tonopah and Round Mountain areas. The rest of the resource area is primarily ranching and grazing and as the only persons resident in the area are those who work on the ranches, employment figures are probably not meaningful.

The only hospital in the resource area is located in Tonopah, and 2 physicians are resident there. Specialty medical services are not available. Dental and optometric services are available intermittently on a "fly in" basis. Shopping facilities are available though costs are higher than those in more developed communities. As a result, a major portion of shopping is done in the larger communities such as Las Vegas and Bishop, California. Rental housing is limited. Prices are high and availability of modern housing for purchase or rental is virtually nonexistent. Utility rates are higher than in most Nevada communities.

The median family income in the Tonopah Resource Area is $10,224, which is slightly less than the State median income level. Families in Nye County having income under $5,000 amounted to 12.5 percent, while 38.2 percent had incomes over $12,000. Seventy-eight families, or 5.9 percent of the families, had incomes under the national poverty level.

In summary, the personal income level in Nye County and the Tonopah Resource Area is comparable to or better than the State level, both for individuals and families. This healthy situation is further reflected by the small number of people on welfare in the area. Forty-three people are receiving welfare assistance, of which four are dependent mothers, and the remaining are elderly or blind people,etc.

Statewide, the service industry has the highest percentage of the labor force (36 percent). This also holds true for Nye County, where the service industry represents 23 percent of the labor force. Construction industry is the next highest,employing 17 percent of the labor force. Construction industry is the next highest, employing17 percent of the labor market. This is due to the construction jobs associated with the Nevada Test Site operations in Nye County.

The agricultural industry represents 7 percent of the Nye County labor market, while the mineral industry employs 14 percent. Public administration and retail trade each have 8 percent, while public education in Nye County employs 5 percent, which is equal to the statewide percentage total. The utilities and other industries have less than 3 percent each of the total labor force in the county.

There are no incorporated towns in the resource area and law enforcement is limited to the Nye County Sheriff's Department and Nevada Highway Patrol.

Outdoor recreation is primarily local except during the hunting season.

An airport capable of carrying limited commercial traffic is located at Tonopah.

The only commercial transportation in the resource area is by bus.

V. ANALYSIS OF THE PROPOSED ACTION

A. Anticipated Impacts

These will be dealt with in terms of the four stages of implementation for living and non-living components.

Exploration

Development

Operations

Abandonment

1. Exploration

Interrelationships and human values will be considered together in Section V, B and C of this document.

a. Non-Living Components

Air: There will be three basic forms of air pollution related to leasing federal lands for geothermal resource development: gases, vapors, and particulate matter.

Based upon limited surface observation, it is not believed that toxic gases will be produced at any of the sites in the area.

Exploratory impacts from geothermal gases or vapors will be primarily from gases vented to the atmosphere during drilling and testing either accidentally or deliberately.

Use would be relatively short term, and it would not be likely that these gases would be produced in quantities sufficient to cause a significant impact upon the environment.

An increase in the quantity of exhaust by-products over the minimal quantities now present in the areas cannot be avoided. These gases would be produced by the internal combustion engines used to power the heavy machinery, vehicles, drilling equipment, aircraft, etc., used during the exploration phase.

Particulate matter (dust) would be generated by the transit of vehicles (both on and off road), by the construction of roads, trails and drill pads to allow the entry and use in the area of drilling and geophysical equipment, and personnel. Relatively smaller amounts of dust would be generated by actual exploration and test drilling.

Airborne dust is offensive to humans and animals and in large quantities can affect plant life. Dust, generated by this phase, would not cause long term impact, but would cause intermittent degradation of air quality in the vicinity of exploration operations.

Noise: Some noise would be generated during exploration. Minor amounts of noise would be generated by aircraft used in airborne surveys (magnetometer, etc.) and vehicles. Noise produced by a truck mounted portable drill rig as would be used in drilling thermal gradient and seismograph holes is of an intensity low enough that impacts of this noise on the environment could be considered to be negligible. It is probable that a few large diameter test borings that could be used as production wells would be drilled. These would be drilled with a conventional oil field type rotary rig. Noise generated would essentially be that of the diesel engines used to power the conventional oil field type rotary drill rig, and the handling of steel drill pipe, casing, etc.

Mud is generally used as the circulatory medium in drilling. Where water flows are not encountered, compressed air may be substituted as the circulatory medium. For example, at the Geysers dry steam field in California, mud is used to the depth where temperature interferes with proper operations, then compressed air is used. Noise created during the air drilling operation is intense and approximately that of an unmuffled diesel truck.

To determine the flow characteristics of well, venting to the atmosphere for a period of time is required. High noise levels would accompany this venting.

Land: The potential for pollution of the soil is generally low. Minor amounts of soil pollutents could be released into the environment by off road vehicles (e.g., oil from damaged crankcases, etc.). Some pollutants would leak from, or be spilled from heavy machinery during the construction of roads, trails, and drill pads. Sterile drill cuttings, drilling mude, and chemicals would be spread upon small plots adjacent to the drill sites, or buried upon abandonment of mud pits at the drilling sites.

The impacts of exploration would range from negligible to high. A high potential for erosion exists after destruction of the protective vegetal cover during the construction of access roads, trails, drill pads, and by off road vehicles. Roads and trails constructed upon steep mountain slopes are particularly susceptible to erosion.

The soil structure could be temporarily altered by off-road vehicle use, and might be permanently disturbed by road and trail construction.

Land use compatibility and suitability is highly varied. With the exception of the playas and adjacent dune areas, any entrance of wheeled or tracked vehicles upon the land will leave marks visible for many years. Roads and drill pads bulldozed upon steep hill sides cannot be restored to any resemblance of their original condition and may lead to rapid erosion. The scars of mining roads of the last century are plainly visible in many areas.

An exploration drilling model is shown in the following table which lists the maximum degree of surface disturbance expected during this phase. This table and the others which follow tend to maximize the degree of surface disturbance which migh occur. For example, fewer than five exploration wells may be needed, one acre per drill site could be used rather than two acres, disposal ponds may not be needed or could be smaller, and fewer access roads may be needed when roads into the area already exist.

Surface Disturbance Expected to Result From Exploration Drilling on One 2560 Acre Lease

Feature	Number of Acres Disturbed	Number of Features	Acres Disturbed
Well	2	5	10
Disposal Pond	4	5	20
Access Roads	1.5	5	8
TOTAL			38
			or 1.5% of total lease area

Revegetation tends to be extremely slow, and the initial flora established usually are undesirable species (halogeton, russian thistle, etc.), or less desirable species (cheat grass). On some roads, the native vegetation has not been completely restored more than 30 years after abandonment.

The above described impacts appear to be compatible with existing and uses except within areas having primitive values, areas of high recreation and/or scenic value, critical wildlife areas, and historic and archaeological values, Incompatibility may be a function of season and climatic conditions.

Drilling Costs for Wells of Different Depths

Depth range (ft)	Cost range ($)
6,000–8,000	$300,000–520,000
8,000–10,000	425,000–770,000
10,000–15,000	635,000–1,055,000
15,000–20,000	940,000–2,750,000

SOURCE: Data compiled by K. E. Brunot, now with Phillips Petroleum Co.

NOTE: Costs are tangible and intangible, for exploratory, development, and reinjection wells. Add approximately $100,000 for each exploratory well. In hot-water systems, one reinjection well is drilled for each development well and each successful exploratory well.

It appears that the areas within the Tonopah resource Area that have potential for geothermal development are suitable for this use.

The entire resource area is suitable for the non-disturbing exploration methods such as magneto-meter, gravimetric, microearthquake, seismograph, and resistivity surveys. There are areas that are not compatible with exploration drilling, development, and operation.

Water: There are several perennial and numerous intermittent streams in the area. Disturbance of the soil by off-road vehicles, road and trail construction, and drill site construction would contribute to an increased sediment load when adjacent to running streams. Drill cuttings and drilling mud discharged onto the surface or into a mud pit have the potential for adding to sediment load.

Some chemical pollution of waters could be caused by discharge of brines onto the surface. These brines could mix with existing surface waters and aquafiers and degrade the quality of available water, to the point where it would not be fit for human or animal consumption and possibly could prove toxic to the native flora.

Temperature contamination of existing surface waters by hotter waters produced from geothermal wells would have major impacts on flora and fauna. Many aquatic plant and animal species are viable only within limited environmental conditions. Discharge of heated or super-heated waters into existing surface water could raise water temperatures beyond the tolerance of indigneous flora and fauna.

The hot springs in Big Smoky Valley, Fish Lake Valley, Hot Creek Valley, and adjacent to the north end of the Toquima Range are critical sources of wildlife and livestock water. At some sites (Spencer Hot Springs) they are the only sources of water for distances as great as 10 miles.

Flows at these springs can be as small as 2 or 3 gpm. Exploratory drilling; the use of explosives in seismographic surveys, the use of the springs as water sources for drilling, etc., could affect the flows and have a high impact on domestic animals and wildlife in the area.

b. Living Components

Vegetation (Terrestrial and Aquatic): Airborne operations during exploration would have no significant impact on the vegetation. The impact of other operations would be very localized. Off road vehicular travel would destroy some fragile broad leaved plants. Road and trail construction and drilling operations would result in removal of vegetation from the roadway or drilling site. Because valley areas seem to be of primary interest in geothermal exploration, trees would not be involved.

For a discussion of aquatic vegetation, refer to section IV, B.2, Description of Existing Environment; Living Components; Aquatic Plants, of this EAR.

Animals: Significant impact on animals would result from most forms of exploration, as a result of primary disturbance. Disturbance from aircraft would be insignificant, however, except for intential harasment. Such as the running of deer and antelope at low altitudes, or the buzzing of nesting sites of raptors. Disturbance by other forms of human activity during certain times of the year can significantly disrupt many vital or essential animal functions related to the species and its habitat requirements.

Sage grouse breeding activities can be disrupted by human activity in the vicinity of strutting and nesting grounds. Strutting grounds which severe as an extremely localized breeding area are usually active from March to May and can vary in size from a few 100 sq. feet to several acres. Nesting grounds can also be somewhat localized. Nest sites usually are within a two miles radius of the strutting grounds and can be communal in that several nest sites can occur within a few hundred square feet. Season of use, of nesting grounds being around the end of the strutting season and may last through the middle of June.

Activity within essential habitat areas for both mule deer and antelope can cause a variety of problems, depending on the season of disturbance. Stress induced by human acitivity during spring months could cause the abortion or abandonment of young, during summer and fall months no human activity is probably more detrimental than the pressure exerted by sport hunting, and during the winter months when certain segments of the population are in a weakened condition due to environmental conditions, human activity and associated harassment can cause stress related mortality to these animals.

The impacts of exploration would of course occur only during the times of actual activity. Probably no permanent damage would result from this phase, however, it would definitely have some temporary effects on animals. Noise levels and associated human activity would cause shy or intolerant species such as mountain lions, bobcats, big horn sheep, and wild horses to temporarily abandon the area. Exploration in the form of continual drilling near a surface water source would cause a noticeable change in the movements and habits of certain species. Sage grouse, mule deer, antelope, and wild horses would become reluctant in using this area and most likely would attempt to locate another source. This change would add additional stress on nearby surface water sources as well as the surrounding animals and vegetation.

2. Development

a. Non-Living Components

Air: The escape of gases and vapors would be greater during this stage than in any other. Numerous wells would have to be drilled, and each would have to be tested prior to being put into production.

To determine flow characteristics and to clean out the boring, each well would have to be vented to the atmosphere. The chemical constituents of the

vapors vented to the atmosphere cannot be predetermined. It does not appear likely that toxic gases would be produced in significant quantity. (Reference is made to section V, 3a, relative to constituents of produced gases.)

Some exhaust fumes and hydrocarbons would be produced by the internal combustion engines powering the vehicles and machinery used in constructing the access roads, drill sites, drilling the wells and constructing the power plants and accessory pipelines and power lines. Particulate matter (dust) would also result from these activities. Temporary localized degradation of air quality would also be expected due to emmission of exhaust fumes, hydrocarbons and particulate matter if a construction camp is set up to facilitate construction of permanent facilities.

It would be inevitable that some leakage of vapors and fumes would occur during pipeline construction and testing, but impacts on air from this leakage would be insignificant.

Noise: Noise produced during this phase would be greater than during the exploration phase, due to the greater number of wells being drilled and tested. Causes of the noise would be the same as those discussed under Exploration. Ambient noise levels would be raised to the level of annoyance for animals and humans within 500 feet of operations. Beyond 500 feet, noises would be noticeable, but the impacts would not be significant.

A complete discussion of drilling noise levels has been made on pages III-23-25 of the Final Environmental State on the Geothermal Leasing Program. A table excerpted from this document is herein included.

Impacts of well drilling and testing will be of relatively short term.

Comparison of noise levels between the Geysers (California) geothermal area and other noise sources follows.

SOURCE	LEVEL	DISTANCE
The Geysers Area		
Drilling Operation (air)	126 dba	25 feet
Drilling Operation (air)	55 dba	1,500 feet
Muffled testing well	100 dba	25 feet
Muffled testing well	65 dba	1,500 feet
Steam line vent	100 dba	50 feet
Steam line vent	90 dba	250 feet
Comparative Levels		
Jet aircraft takeoff	125 dba	200 feet
Threshold of pain	120 dba	
Unmuffled diesel truck	100 dba	50 feet
Street Corner in a large city	75 dba	
Residential area at night	40 dba	

dba: Decibel value measured using the weighting network of a standardized sound level meter.

Land: The impacts on the land during development would essentially be the same as those during exploration though greatly magnified. Less disturbance from off road vehicle use would result, but construction of permanent roads, power plants, accessory pipelines, power lines, and cooling and settling ponds will alter soil structure, depth, and nutrient properties over large areas, if used.

Construction activities required to develop two 100 megawatt power plants, associated wells, pipelines, roads, and transmission lines are listed in the following table. The number of wells includes those used for production, standby, and reinjection. Since development is likely to occur in about 50 megawatt increments over a period of several years, the degree of surface disturbance at any given time is less than assumed in the model. Mitigation and enhancement will have occurred in some portions of the lease before additional portions of the lease are developed.

Surface Disturbance Expected to Result From Development of Two 100 Megawatt Power Plants on One 2560 Acre Lease

Feature	Number of Acres Disturbed	Number of Features	Acres Disturbed
Power Plant	5	2	10
Well	2	65	130
Disposal Pond	4	20	80
Pipeline	1.2	50	60
Access Rd (spurs)	0.9	65	59
Mainline Road	12	1	12
Transmission Line	4.5	2	9
TOTAL			360 or 14% of total lease area

Area disturbed in the model above are maximumx. It is probable that actual areas disturbed would not be this great.

Based upon present knowledge, it is not likely that more than 1.5% of all the lands opened to geothermal leasing would be developed. If 1.5% of the lands qualified for leasing are developed to the maximum as indicated in table 2 (above) 0.21% of the leasible lands would actually be used for geothermal development. The Tonopah Resource Area contains approximately six million acres of this acreage, approximately 68,000 acres is in private and state ownership, 2,226,000 acres is under USFS jurisdiction, leaving approximately 3,800,000 acres under BLM jurisdiction. Based upon multiple use constraints, and highest and best use evaluations, a maximum 60% to 70% of the federal lands may be opened to geothermal leasing. The preceeding analysis of surface use that 0.21% of the lands open to leasing (7,550 - 8,800 acres) would be the most that may be disturbed by surface usage connected with geothermal development.

The changes in soil properties (transportation, compaction, pollution, mining) due to construction would be long term, and could have a high impact locally in that use of these lands for uses other than power production would be denied.

Intensive disturbance during construction will present the opportunity for localized wind and water erosion to have a significant impact.

The expected impacts on geologic structure would be:

(1) The drill holes themselves, impacts would be negligible.

(2) Fracturing, and other techniques required to bring the well into production, impacts would be negligible.

(3) Possible loss of porosity and permeability in the geothermal producing zone due to withdrawal of fluids and resulting consolidation of the aquafier materials. Impacts would primarily be on the life of the field and cannot be ascertained at this time due to insufficient data.

Possible use of nuclear explosives in geothermal development cannot be evaluated at this time and should be considered separately if the need and occasion should arise.

Some soil pollution could be expected as a result of production of brines. This is another item on which parameters are not a present clearly defined.

It is likely that a construction camp would be set up in order to facilitate construction of some of the sites due to the remoteness of large portions of the area. Impact of a temporary construction camp would be pollution of the soil and disturbance of the soil structure at the campsite and at the accessory waste disposal facilities.

High voltage power transmission lines leading from the power plant sites would have to be constructed during this stage. Impacts of these lines cannot be evaluated at this time as routes are not known. Individual EARs would be required prior to granting Rights-of-Way for construction of these lines if needed.

Minor chemical pollution could result from drilling operations and the construction of permanent facilities.

It would be likely that some spillage of solvents and chemicals associated with construction of the plants would occur.

Land Use Compatibility and Suitability: Reference is made to the discussion incorporated under the Exploration phase.

Water: Other than the impacts outlined under exploration, the discrete operations during development that would affect water are the production of brines and highly mineralized waters during drilling and testing of wells and possible coliform contamination from a construction camp.

Production of brines and mineralized waters could chemically contaminate surface waters and shallow subsurface waters so as to render them unfit for support of animal and vegetable life. (Significant impacts are unlikely in the light of current drilling practices.)

Thermal contamination of existing waters could be more significant at this stage than during exploration due to a greater volume of geothermal waters produced. Reference is made to the impacts discussed under Exploration.

b. Living Components

Vegetation (Terrestrial and Aquatic)

The impacts on vegetation of road construction and improvement and of drilling operations would be similar to that under exploration. Though drilling operations would involve a larger area during development than during exploration. They would be quite local.

An impact which would influence vegetation would occur if the water regime were disturbed. It is unknown whether tapping geothermal resources will influence surface water. It is possible that the flow of springs in the vicinity of a development could be reduced or stopped entirely. If this occurred the vegetation dependent on this water source would be reduced or eliminated.

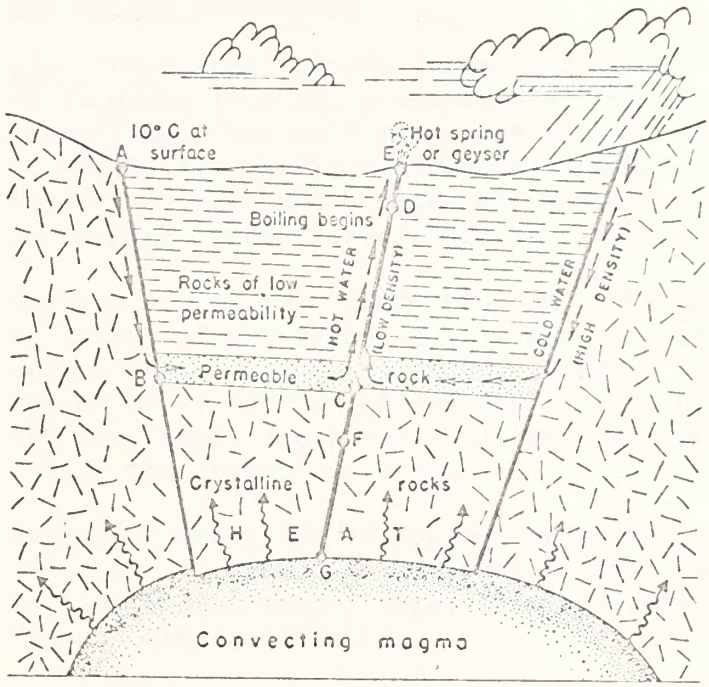
Animals(Terrestrial and Aquatic): Within this phase, disturbance and elemination of existing underground or surface water sources could have more of a significant impact on both aquatic and terrestrial animals. If the water supplied was eliminated, those animals dependent on it or upon the vegetation it supported would have to permanently change their life habits either by migrating out of the area or staying to face the destruction and elimination of it's habitat. However, if the flow were only reduced, competition for available water and vegetation would be intensified and only the more agressive and stroneer species would survive at that location.

Of particular interest are the relict fish species which survive in Railroad Valley. Disruption of their habitat would probably push them to extinction. Lahontan cutthroat trout may be found in some of the perennial streams.

The construction of distribution and transmission lines would provide a current deficient segement of the habitat or raptors. These structures would be used as perches and resting sites by these birds. The availability of these perch and rest sites could result in local increases of raptor populations or extensions of present ranges, if sufficent prey species existed within the area. With this increase in population levels the increase of occurrence in raptor electrocutions could also have a deteramental effect on the overall total population. Perventive measures to eliminate raptor electrocution should be taken to avoid this situation.

The impact on animals from the construction and the construction camp would result from the presence of human habitation and related activities. Localized and minimal destruction of habitat, reduction in isolation qualities, and an increase in animal stress would result. The previously mentioned impacts would be negotiable concerning habitat, however, the loss of the animal's feeling of isolation would be gone, and the increase in occurence of stress on game animals related to construction personnel and additional harrassment by ORV use would be significant.

Road construction and development would also destroy small amounts of habitat, increase the number of animal road deaths, and possibly interfere with seasonal or daily migration routes. These impacts, however, would be insignificant in that except for road death most animal species could adapt.



model of a high temperature geothermal system

3. Operations

It would be likely that additional wells would be drilled throughout the life of the field. These wells would be used to replace and supplement previously drilled wells. (Refer to the technical report for a discussion of this requirement). The impact of these additional wells would be the same as the impact of wells drilled during the Development stage (Section V, A, 2 above) on all phases of the environment. Additional pipelines to transmit the geothermal gases and fluids would be constructed, and impacts would be the same as those discussed under Development.

a. Non-Living Components

Air: Geothermal vapors (steam and fumes) could be released into the atmosphere at any time during operations. New well sites, pipelines, maintenance of facilities, geothermal waste disposal, and actual production all have a potential for allowing vapors to escape. Impacts would not be significant.

Particulate matter, production and impacts, would be insignificant except during new well site development. Carbon monoxide, internal combustion engine by production of and the impacts of products (hydrocarbons, etc.) would not be significant during the operations stage.

Possible production of noxious or toxic gases (H_2S, etc.) cannot be evaulated at this time due to lack of sufficient data, though significant impacts are not likely.

Noise: Noise generated by drilling and testing of supplementary wells during the Operations phase would be the same as that discussed under exploration, except that it is probable fewer wells would be drilled during this phase.

Increase in ambient noise levels due to actual power generation will be similar to the noise generated by a fossil fuel electric plant of similar output.

Actual noise impacts from power generation cannot be quantified at present.

Land: Development of additional wells and accessory pipelines and roads would result in surface disturbance which may cause erosion. The surface disturbance would be similar to that described under Exploration but less extensive. Areas impacted would be small.

Disposal of waste waters into evaporation ponds could cause minor chemical pollution of the soil immediately adjacent to the ponds.

Impacts would be minor as the zone of contamination would be relatively small and immediately adjacent to the evaporation pond.

Geologic structure could be affected in that continued withdrawal of liquids from the reservoir could lead to consolidation of the reservoir strata, which in turn, could lead to surface subsidence (Leggett, Geology and Engineering, 1962, pages 404-406), as well as the impacts previously described under development.

The potential for a change in seismic activity (increase or decrease) is very real. Withdrawal or injection of fluids in or adjacent to fault zones have been shown to affect seismic activity in an area. Parameters are not adequately defined in this area at present.

Land Use Compatibility and Suitability

Reference is made here to the discussion incorporated under Exploration.

Water: The quantity of water that would be produced from the operation of geothermal power plants in the area cannot be adequately evaluated at this time due to lack of pertinent data. It would be assumed that the waters produced from geothermal wells would have similar chemical compositions, PH, etc., to the natural geothermal waters in an area.

Geothermal waters presently produced are generally non-toxic and are commonly used by livestock and wildlife.

A possibility does exist that water may be made available for various other uses such as wildlife habitat, irrigation, etc.

It would not be unreasonable to assume that a portion of the waste waters resulting from geothermal wells would be reinjected into the reservoir. This would of course, be dependent upon the geologic characteristics of the reservoir. Reinjected fluids would have no impact upon the surface environment.

Thermal pollution of surface waters by geothermal fluids could seriously affect the suitability of the surface water for support of indigneous flora and fuana (as noted under Development).

b. Living Components

Impacts upon living components by the expansion of the plant (including drilling of additional wells) would be the same as those described under Development though on a much smaller scale.

Vegetation: Significant effects on vegetation of the operation of a power generating plant are problematical. It is likely, disposal of waste water would have significant impacts, depending upon the mode of disposal. These impacts would result from cooling of hot water and disposal of cooled water.

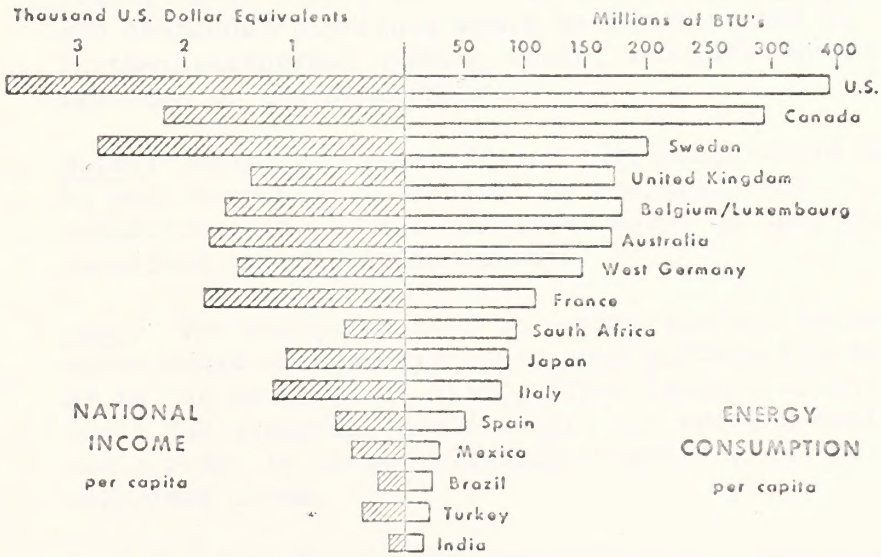
The evaporation of large quantities of water could alter the local climate somewhat, making it more humid. This could result in local establishment of plants adopted to more humid climates at the expense of the native desert type species, on the other hand, it may result only in more vigorous and profuse growth of existing species.

If waste water is reinjected into wells, this would not have a significant impact on vegetation.

Animals (Terrestrial & Aquatic): The impact of power plant operations, related structures and improvements would be significant as related to waste water disposal. Available water in excess amounts of current production may become available to current animal populations, thereby significantly increasing the possibility for an increase in total animal numbers and diversity. Other animal species would move into and fill all available highes which would be created by the improved water production.

Agricultural development, if sufficient water and soil conditions exist, would also have an impact on existing and potential animal populations. Normally, this increase in available habitat results in an overall favorable impact concerning animals and animal numbers.

Human activity, any increase in ambient noise levels, harassment, creation and a destruction of habitat, etc., may have a significant impact on animal populations and life histories (as noted under development).



1968 per capita income and energy consumption for seventeen selected countries. (Source: U.S. Department of the Interior, "United States Energy: A Summary Review," 1972.)

4. Abandonment

It is probable that abandonment of a geothermal power plant would take place gradually, as pressures, and geothermal fluids in the field are depleted, rather than in the short, well defined time frame generally associated with the dismantling of an industrial facility such as a manufacturing plant or smelter.

Abandonment does not necessarily imply that physical plant facilities would be completely removed as other suitable and compatible economic uses may be found for these facilities.

a. Non-living Components

Air: Some particulate matter (dust would be generated by the physical tearing down and removal of the power plant and associated facilities (pipelines, power lines, etc.). Wells would be plugged and abandoned pipelines would be removed, and no further geothermal vapors, fumes, and gases would released to the atmosphere.

Noise: Noise generated during this phase would be by machinery used in removal of equipment and rehabilitation. Noise generated would be less than described under previous phases.

Land: The equipment used to remove surface improvements would undoubtedly cause some surface disturbance. As in the development stage, minor impacts on soil depth and structure could occur, and erosion could occur prior to re-establishing vegetation on the reclaimed areas.

Land Use Suitability and Compatibility: Abandonment might affect those uses that have developed resultant to geothermal development. Abandonment would allow the use of the land for other suitable uses.

Water: No further impact upon surface or shallow subsurface waters would be expected after production ceases and the wells are plugged and abandoned. The quality and quantity of surface water could return to a condition similar to that in existence prior to commencing geothermal operations.

There is the possibility that flows, from pre-existing springs affected by geothermal operations, would not revert to their previous flows.

b. Living Components

Vegetation: Removal of physical plant and human occupation would allow the re-establishment of flora low on the succession scale such as halogeton and related species.

Animals: The impact of abandonment operations on animals would depend upon which course of action is taken. If abandonments were to consist of complete removal of the physical plant and associated structures, animals which were attracted to and utilized the existing artifical habitat would lose this habitat. Displacing these animals by elimination of their habitat would have a small and overall insignificant impact. With complete removal and necessary surface reclamation and restoration or through the complete natural successional process re-establishment of native animals could reach levels comparable to pre-construction levels. With partial removal of existing structures animals associated with both the artificial habitat and native habitat would reach some form of equilibrium.

B. Anticipated Impacts on Ecological Interrelationships

In those areas where the vegetation is destroyed, the ecological interrelationships will be disrupted. The plants are the base of the food chain and without them, the herbivores cannot survive in the area, and if there are no herbivores, the predators will not survive in the area.

Human activity will modify the activities of the native fauna in areas adjacent to any activity site.

The ecological impacts will vary from high locally to insignificant from the standpoint of a general overview due to the widespread occurrence of that community type.

The following discussion concerns those impacts that are significant in our view.

Alteration of water temperature may eliminate certain species of algae; dessication of a spring would alter the vegetation at the site, which would in turn, alter the kinds of animals which use the area.

Possible impacts resulting from the availability of perches for raptors could be decrease in rodent populations resulting from increased predation by these birds, it could also result in an overall decline in raptor populations resulting from electrocution of the birds by power lines.

C. Anticipated Impacts on Human Values

1. Landscape Character

The disturbance caused by implementation of the proposed action will be readily apparent in this type of terrain and will be slow to heal.

Power plants and their associated facilities would be readily visible to the casual observer, and would stand out in contrast to the surrounding landscape.

2. Sociocultural Interests

Development of geothermal power plants will increase the availability of electrical energy in the local area. This would have the potential for increased and more stable industry within the area.

Population levels and districution would be effected by the proposed action. Exploration would bring into the area a small, mobile, highly specialized work force that will have little impact on the area. Development would bring a large transient work force that would be employed in the construction of permanent facilities into the area. This transient work force could place enormous demands upon schools systems, housing, etc., (as can be seen in the case of the Jim Bridger Power Plant at Rock Springs, Wyoming) and then depart at the completion of construction activities. This temporary impact would be of short duration, probably 3 to 10 years. A relatively small, stable work force of possibly a hundred persons would remain to operate the facility.

Local business activity would follow the "boom and bust" cycle just noted.

There would be an increase in tax revenue to local governmental entities during the life of the project.

Greater demands would be placed upon the public lands for recreation due to the increased population.

It is certain that a sudden expansion in population even though it is temporary, would overtax the service sector of the existing area, and possibly could heavily impact the existing political environment.

VI. POSSIBLE MITIGATING OR ENHANCING MEASURES

Mitigation of some of the impacts upon the environment would be accomplished through enforcement of federal, state and local laws and regulations.

The regulation of geothermal exploration, production, etc., is covered by the Geothermal Steam Act of 1970, 43 CFR 3200, the National Environmental Protection Act, and the regulations of BLM and USGS. Stipulations for protection of the environment will be included in every geothermal lease, notice of intent, and geothermal operating regulations and orders.

Known and anticipated impacts have been included in this analysis. Unanticipated environmental impacts which become apparent as a result of geothermal development will have to be dealt with as they become apparent.

The production of energy, especially a relatively clean and non-polluting production of energy with minimal surface disturbance could be considered a mitigating measure in itself.

Use of geothermal energy for other appropriate uses such as space heating, industrial processing, agriculture, would be an enhancing measure.

VII. RECOMMENDED MITIGATING MEASURES

A. General

1. Protection of archaeological values. In Nevada, as in other desert lands, archaeological values tend to be located in the vicinity of available surface waters. An archaeological investigation should be required of all sites and areas upon which the surface will be disturbed (constructed roads, drill sites, waste disposal ponds, power line tower or pole sites, pipelines Rights-of-Way, building sites, actual power plant locations, gravel pits and/or quarries and any area to be graded, graveled or paved).

2. Soil and Vegetative Protection and Restoration

a. Whenever possible, existing roads and road Rights-of Way should be utilized. New road construction and reconstruction should be approved by the Surface Management Agency and Area Geothermal Supervisor.

b. Temporary roads should be built with as little soil and vegetation cover disturbance as possible. "Dropping the blade" clearing of temporary roads should not be permitted unless prior clearance is obtained.

c. Clearing for drill sites should be limited to minimum size practical for operations.

d. If leveling is required on drill sites, top soil should be stripped and stockpiled for respreading upon abandonment of temporary drill sites, and use in rehabilitation of excess area needed for drilling, but not required for operation of wells.

e. Upon abandonment of roads, drill sites, etc., compacted areas should be water=barred, scarified and reseeded. Reseeding should be done with the plant species and at the time of year specified by the Surface Management Agency.

f. Off-road vehicle travel should be restricted in the spring or after heavy rainfall when the soils are wet and muddy. Off-road travel should be held to an absolute minimum.

g. All machinery and test wells should be equipped with appropriate mufflers to meet current noise contamination standards.

3. Protection & Enhancement of Wildlife Habitat

a. Based upon BLM and USFS planning system data a large portion of the mountainous areas (under both BLM and USFS jurisdiction), essentially those areas contain existing or potential bighorn sheep range, the Table Mountain area proposed for elk introduction and the Morey Peak area have been set aside as requiring further environmental study.

b. Limitations upon season-of-use on lands containing "crucial" habitat as may be deemed necessary for the protection of the individual species.

c. No improvements upon selected lands (such as sage grouse strutting grounds).

d. Siting of improvements so as to minimize disburbance of habitat.

e. Use of test and production borings to produce additional waters.

f. Reseeding of disturbed areas with forage species desirable for wildlife.

B. Exploration

The items noted under Mitigating Measures, General, are included here by reference.

C. Development

The items noted under Mitigating Measures, General, are included here by reference.

1. Roads: Provision should be made for control of particulate matter (dust) by watering or other acceptable means during periods of heavy use to meet air quality standards.

2. Permanent work areas around wells should be graveled to prevent erosion and production of particulate matter (dust). Permanent access roads should be graveled or paved.

3. Consideration should be given to landscaping of power plants, pipelines, and well heads to minimize visual impacts. Color of power plants, pipelines, etc., should be chosen, where practicable, to blend with the existing environment.

4. Steps should be taken to prevent electrocution of eagles, hawks, and other birds in designing electric transmission lines, substations, and other electrical power facilities. REA standards would be the minimum acceptable.

5. Disposal of geothermal fluids produced during testing of wells should be handled so as not to contaminate surface waters.

6. After completion of drilling, sumps should be cleaned out, backfilled and restored rather than fenced and allowed to dry out. Waste material shall be disposed of as agreed to by the surface protection agency.

7. Design and location of cooling ponds should be approved by the Surface Management Agency.

8. Plant sites should be fenced so as to provide protection for livestock and wildlife.

D. Operations

General and Development mitigating measures are included here by reference.

1. New Drill Sites: These measures will be the same as for drill site development under the Development phase.

2. Waste Disposal:

   a. Evaporation (Cooling) Ponds. If the water quality is good, steps should be taken to utilize the

waters in a manner beneficial to wildlife and livestock. If the waters are toxic, steps should be taken to prevent poisoning of wildlife, livestock and humans.

b. Reinjection. Care should be taken to prevent contamination of aquafiers which are used, or have potential for, water supply.

E. Abandonment

Abandonment of a geothermal field and removal of plant and surface equipment would occur over a long period of time as the field depletes. A restoration and reclamation plan spelling out generalized mitigating measures should be required prior to issuance of permits to proceed with construction of facilities. Requirements for restoration and reclamation would be varied dependent on the individual site.

VIII. RESIDUAL IMPACTS

Development of geothermal resources would have a cumulative residual impact in that the evidence of the presence of man and his works would be evident for years to come. The traces of roads and pipelines, and the location of physical plant sites would be evident to the trained observer for thousands of years, no matter how thoroughly restoration and reclamation are done. Residual impacts in the surrounding areas cannot be realistically evaluated at this time. Population increases resultant from geothermal development could be either permanent or temporary dependent upon innumerable factors other than the presence of a goethermal power plant.

The history of Nevada shows many examples of populations thought to be permanent that were, in reality, ephemeral (Goldfield and Tuscarora are prime examples). Predictions as to the possible development of a resource and the effects on surrounding areas and population cannot be considered meaningful when the time period involved is in excess of ten to twenty years.

Subsidence caused by withdrawal of fluids may be considered to be permanent.

Access into remote areas may be made simpler and the values of solitude and remoteness would be compromised.

Ecological processes will be impacted as previously described.

IX. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Development of the geothermal resource potential in the Tonopah Resource Area would tap a previously unused natural resource to supplement and replace energy sources now used to supply the existing and future demands of the nation. The leasing of lands for geothermal development would involve commitment of a portion of the available resources of land, water and air of the sites involved. The lifetime of the potential energy sources cannot be predicted accurately, though lifespans in excess of 30 years may be considered reasonable, (Larderello Field in Italy has been in continuous production since 1905). It is possible that as technology develops these potential sources of energy could have their lifespan extended.

At some time in the future, these sources would no longer prove economic. At that time, the leases would terminate, facilities would be dismantled and the land restored as much as may be practicable. The combination of reclamation and restoration, plus natural vegetation recovery should result in reversion to a natural condition similar to that prior to commencement of operations. At the present time, a majority of the lands in the resource area are limited as to their productivity from the standpoints of agriculture, wildlife, etc., because of insufficient rainfall.

If the proposal is implemented high productivity for a relatively short term (the life of the project) will be realized. After abandonment and reclamation and restoration, these lands should revert to approximately their present level of productivity.

X. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Depletion of water and thermal energy from the geothermal reservoir. The prime item of importance here is depletion of water. The depletion of available thermal energy from a source of this type is not a realistic consideration.

Consolidation of aquafers in the geothermal reservoir and the land subsidence and changes in surface drainage patterns, etc., that may result from removal of fluids from the geothermal reservoir.

Permanent scarring of the landscape resultant from construction activities.

Loss of remoteness due to improved access.

XI. IMPACTS OF THE ALTERNATIVES

A. Do not allow leasing of non-excluded lands within the resource area. This altnerative would involve an administrative decision of the Secretary of the Interior not to lease for geothermal resource development any of the federally owned lands within the resource area after examination of the recommendations of the surface management agencies.

A decision not to lease could seriously hamper development of the resource. Orderly and efficient development of federally owned lands and privately owned lands will require that potential geothermal resource lands be developed as a unit rather than piecemeal if the best longterm interests of the government and the private landowners are to be served.

If development does take place, alteration of the existing environment would occur to a significant degree in areas of private land ownership whether or not leasing of federally owned lands takes place, as significant geothermal development will (and for that matter has already occurred) on the privately owned lands.

Some domestic energy sources will have to be developed whether or not leasing of federally owned geothermal resource occurs. At best, the decision not to lease could be considered a poor trade-off as geothermal energy has the potential for having a lesser environmental impact than the development of other energy sources at the present and imminent levels of technology (for a complete discussion of these alternatives see "Final Environmental Statement for the Geothermal Leasing Program" U. S. Department of the Interior, 1973).

B. Lease only as may be required to honor grandfather rights (as defined in 43 USC 3230). It is believed that there are no "Grandfather Rights", as defined in 43 USC 3230 within the area under discussion. Should controversy arise, this would be a matter for the judiciary to decide.

Essentially, this alternative is the same as alternative A preceding, and the discussion therein is included by reference.

C. Lease only those portions of the resource area upon which impacts will be minimal. In the Tonopah Resource Area, those areas upon which minimal impacts would be caused by geothermal leasing are not the areas which show potential for geothermal energy production. In essence, this alternative is a variation of Alternative A whether or not to lease, and reference is made to the discussion included therein.

XII. PERSONS, GROUPS, AND GOVERNMENT AGENCIES CONSULTED

Eric Cronkheit - State Historic Preservation Officer
Glade Quilter - District Ranger - USFS
Clare Baldwin - District Ranger - USFS
Garth Baxter - District Ranger - USFS
Norman Stark - Geologist - USFS
Conservation Division - USGS
Geologic Division - USGS
Nevada Department of Fish and Game
Nevada State Museum
Nevada Outdoor Recreation Association
Nevada Organization for Wildlife
Desert Research Institute, University of Nevada, Reno
Sierra Club
Foresta Institute
WHOA (Wild Horse Organized Assistance)
Geothermal Resources Council
Ed Johnson - Geologic Division - USGS
Nye County Administrator
Ely District Office - BLM
Las Vegas District Office - BLM
Carson City District Office - BLM

XIII. INTENSITY OF PUBLIC INTEREST

Public interest concerning the development of geothermal resources in the Battle Mountain District could best be described as curiosity at the present time. Numerous articles have been published in newspapers and magazines, and television news items about geothermal leasing and exploration have brought an awareness of the possibility of geothermal power development to the general public and the local governmental and regulatory bodies.

Generally, the possibility of geothermal power plants has been accepted, but no controversy has evolved for the areas involved. Concern has been expressed by segments of the public as to the possibility of "drying up" hot springs, and lowering the quality and quantity of forage in the areas watered by the hot springs. These possibilities have been discussed under impacts of the proposed action.

Local governmental units generally welcome the possiblity of geothermal power plant development, with the prospects for increased tax base and revenue.

To some extent, there are apprehensions that an awareness of the additional demands that would be placed upon them in the fields of education, law enforcement, providing of water supplies and sewage treatment facilities to name but a few.

XIV. PARTICIPATING STAFF

Samuel Rowley - Area Manager - Tonopah
Terry Reed - Wildlife and Recreation Specialist
Theodore W. Holland - Geologist
Michael C. Mitchel - Wild horse Specialist
Sheridan C. Hansen - Chief, Resources Management
David F. Everett - Environmental Coordinator
Lee E. Hughes - Range Conservationist

XV. RECOMMENDATIONS ON ENVIRONMENTAL IMPACT STATEMENT

No environmental impact statement is necessary at this time in the analysis.

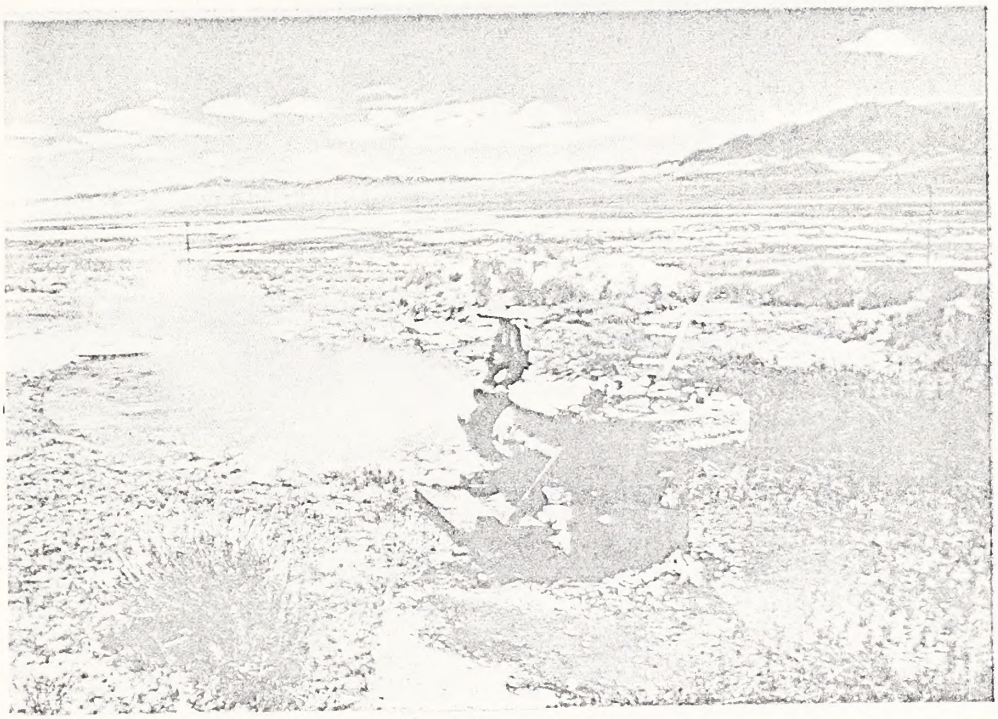
XVI. SIGNATURES

Prepared by: _____ Feb. 20, 1975
THEODORE W. HOLLAND — Date
Geologist

Reviewed by: David F. Everett 2-20-75
DAVID F. EVERETT — Date
Environmental Coordinator

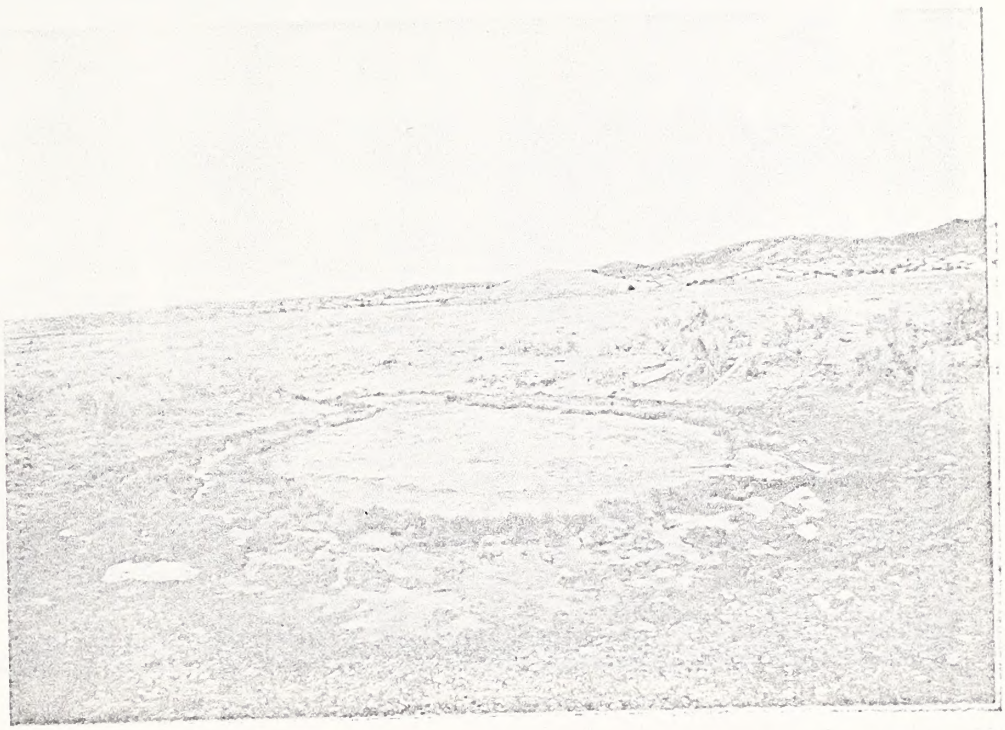
Samuel R. Rowley 2/24/75
SAMUEL R. ROWLEY — Date
Area Manager, Tonopah RA

Concurred: Gene Nodine 2/25/75
GENE NODINE — Date
District Manager

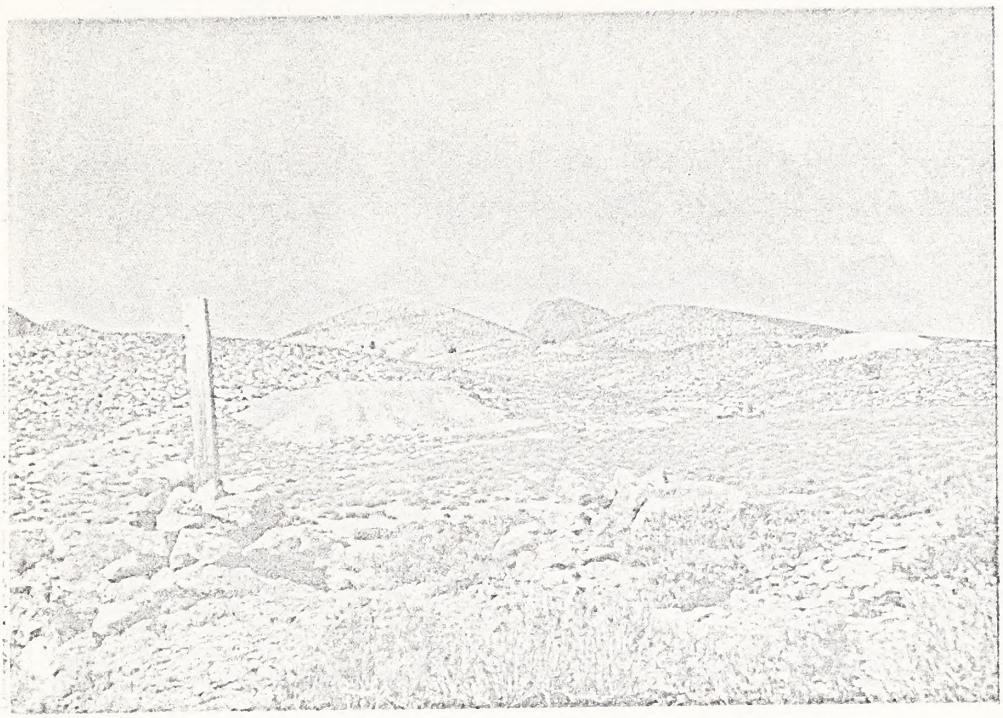


The Darrough "Steam Well" at Darrough Hot Springs (a KGRA), in Big Smoky Valley. This well was drilled by Magma Power Company in 1962 to a depth of 812 feet. Maximum well temperature recorded was 265. degrees Fahrenheit(129 C). As with all the early geothermal wells in Nevada,this well was drilled adjacent to a thermal spring.

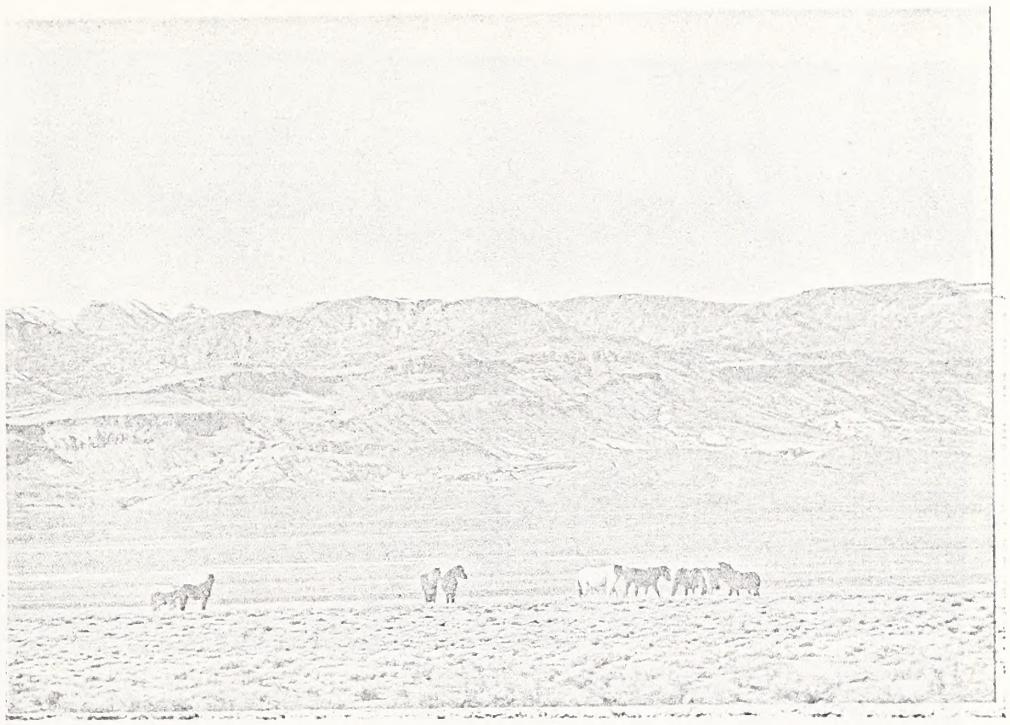
A thermal spring at Spencer Hot Springs in northern Big Smoky Valley. The Toiyabe Range is in the background. As with many thermal springs, this area was developed as a spa by shallow wells drilled in the sinter terrace. Maximum spring temperature is 117 degrees Fahrenheit (47 C).



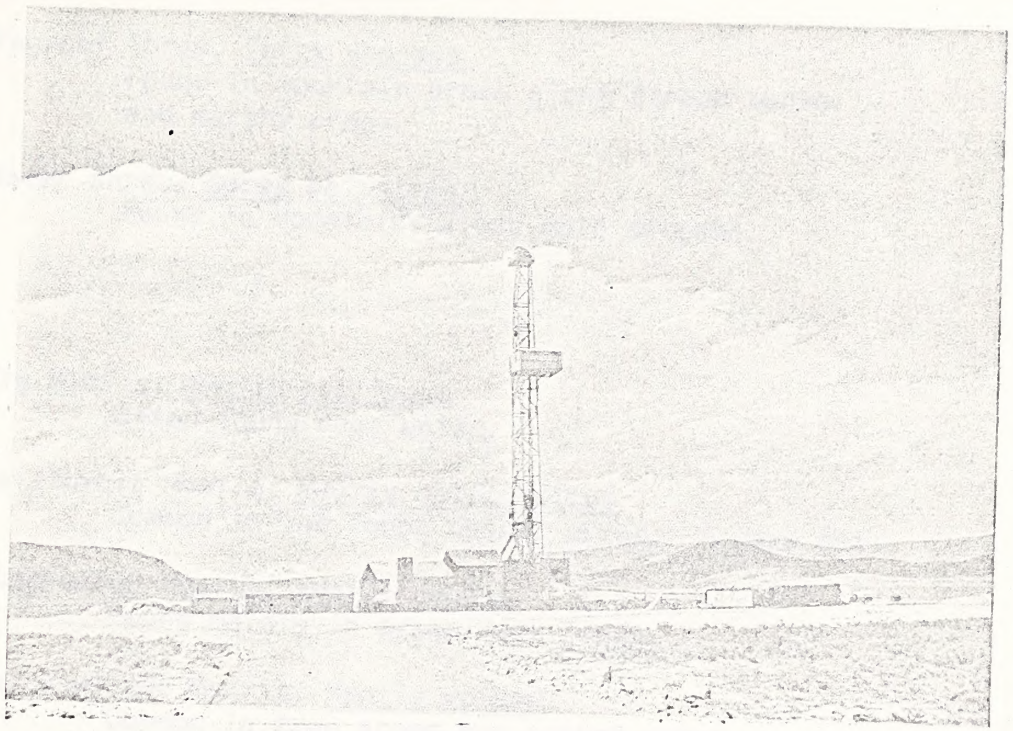
Thermal Spring in Little Fish Lake Valley. Temperature is 117 degrees Fahrenheit(47 C).Note tracked area in the edge of the spring pool showing evidence of livestock, wild horse, and livestock usage.



Many of the lands within the Tonopah Resource Area bear witness to surface disturbing activities of the past. This photograph, taken in the Arrowhead District in the Reveille Range shows typical relict features of mining activities of the past.



Wild free roaming horses in Hot Creek Valley.
The Hot Creek Range is in the background.
Wild horses and burros, protected by the Act
of December 1971, are to be found throughout
much of the Tonopah Resource Area.



Montgomery Drilling Company oilfield type "jackknife" drill rig used to drill Chevron-American Thermal Resources Guinn No.1 test well in the Beowawe KGRA in spring 1974. This rig is typical of the type that would be used to drill deep exploratory and production geothermal wells. This type and size of rig is capable of reaching a depth of 12,000 feet with a 10 inch hole.

LIST OF THE MAMMALS FOR THE TONOPAH AREA

SHREWS:

Vagrant Shrew, Sorex vagrans
Found in mountain areas along stream banks and marshy areas.

Water shrew, Sorex palustris
Found in mountains along cold streams.

BATS:

Big Myotis, Myotis lucifugus
Often found near water.

California Myotis, Myotis californicus
Common in the lower desert areas. A cave bat.

Long-eared Myotis, Myotis evotis
Found mainly in areas with trees.

Hairy-winged Myotis, Myotis volans
Common in tree areas and around water.

Small-footed Myotis, Myotis subulatus
Usually found below 6,500 feet.
Uses niches in rocks, trees, or buildings to roost.

Euderma maculata
Very rare in State -- may be located in District. Please report any findings.

Hoary bat, Lasiurus cinereus
A colonial bat found in the lower areas of the District.

Big brown bat, Eptesicus fuscus
Common. A cave bat.

Western pipistrelle, Pipistrellus hesperus
In western and southern parts of State.

Long-eared bat, Corynorhinus rafinesquii
Found occasionally.

Palled bat, Antrozous pallidus
A common cave bat in southern part of District.

Mexican Bat, Tadarida Mexicana.
A common cave bat. Distribution limited to southern part of District.

WEASEL FAMILY:

Short-tailed weasel, Mustela cicognanii.
Found in the higher mountains of District, but travels to lower elevations during winter.

Long-tailed weasel, Mustela frenata.
Located throughout District.

Mink, Mustela vison.
Habitat restricted to lakes, streams, and water courses.

River Otter, Lutra canadensis.
Found along Humboldt River.

Spotted skunk, Spilogale gracilis.
Occasional in District. Nocturnal in habits.

Badger, Taxidea taxus.
Fairly common throughout the District.

DOG FAMILY:

Red fox, Vulpes fulva.
Recorded in southern portions, but not common.

Kit fox, Vulpes macrotis.
Found at lower elevations. Small big-eared fox.

Gray fox, Urocyon cinereoargenteus.
Found mainly in southern portion of District.

Coyote, Canis latrans.
Common throughout the District.

CAT FAMILY:

Mountain lion, Felis concolor.
Found in most higher elevation areas.

Bobcat, Lynx rufus.
Common in entire region, although not abundant.

RODENT FAMILY:

Yellow-bellied marmot, Marmota flaviventris.
Very few sightings have been made of this species in the District. Found in higher mountain areas.

Townsend ground squirrel, Citellus townsendii.
Distributed throughout area, commonly seen.

Richardson ground squirrel, Citellus richardsonii.
Found in the Diamond Valley area of Eureka County.

Belding ground squirrel, Citellus beldingi.
Noted to exist in most of the District.

Rock Squirrel, Citellus variegatus.
Inhabit southern portion of District.

Antelope ground squirrel, Citellus leucurus.
Common throughout the District.

Golden-mantled ground squirrel, Citellus lateralis.
Found in higher elevations. Commonly mistaken for Chipmunk.

Least chipmuck, Eutamias minimus.
In sagebrush areas and valleys. Smallest of Nevada Chipmunks.

Cliff chipmunk, Eutamias dorsalis.
Among pinons and junipers.

Say chipmunk, Eutamias quadrivittatus.
Higher zones of the isolated central mountain ranges.

Little pocket mouse, Perognathus longimembris.
Found in very arid areas.

Great Basin pocket mouse, Perognathus parvus.
Inhabits areas far from water.

Long-tailed pocket mouse, Perognathus formosus.
Found in eastern part of District in stoney habitats.

Dark kangaroo mouse, Microdipodops megacephalus.
Most frequently found in central and western part of District.

Pale pygmy kangaroo rat, Microdipodops pallidus.
Within District, restricted to western Nye County.

Ord Kangaroo rat, Dipodomys ordii.
The most common knagaroo rat, located in lower elevation areas.

Great Basin kangaroo rat, Dipodomys microps.
Found in sagebrush and shadscale, greasewood communities.

Northern pocket gopher, Thomomys bottae.
Common throughout District.

Northern grasshopper mouse, Onychomys leucogaster.
Common in upper Sonoran Life-zone.

Southern grasshopper mouse, Onychomys torridus.
Occupies lower areas in southern portion of District.

Western harvest mouse, Reithrodontomys megalotis.
May be found anywhere in area, but especially in grassy places near water.

Canyon mouse, Peromyscus crinitus.
Lives in stony places among rocks, especially in canyons.

Deer mouse, Peromyscus maniculatus.
One of the most abundant rodents almost anywhere.

Pinon mouse, Peromyscus truei.
Generally found in rocky areas supporting pinon pines.

Long-tailed meadow mouse, Microtus longicaudus.
Mostly found in the higher mountainous areas.

Montane meadow mouse, Microtus montanus.
Found in higher areas throughout District.

Sagebrush Vole, Lagurus curtatus.
Lives in colonies in brush communities.

Bushy-tailed wood rat, Neotoma cinerea.
Common in District. Characteristically builds nests of sticks and similar material.

Desert wood rat, Neotoma lepida.
Occurs in lower areas of district. Nest is a mound of sticks.

House mouse, Mus musculus.
Non-native, but now distributed througout District.

Big jumping mouse, Zapus princeps.
Inhabits the higher portions of District. Often lives near streams. Nocturnal.

Muskrat, Ondatra zibethica.
Aquatic. Often builds nest in waters.

Beaver, Castor canadensis.
Largest rodent, inhabits aquatic areas.

Porcupine, Erethizon dorsatum.
Found in sagebrush and meadows as well as forests.

Pika, Ochotona princeps.
Found in rocky slopes at high elevations.

RABBIT FAMILY:

White-tailed jackrabbit, Lepus towsendii.
Very rare in District.

Black-tailed jackrabbit, Lepus californicus.
Very common and abundant throughout District.

Nuttall cottontail, Sylvilagus nuttallii.
Rather common, especially along streams and canyons.

Audubon cottontail, Sylvilagus audubonii.
Restrict to southern part of District.

Pigmy rabbit, Sylvilagus idahoensis.
Mainly found in areas of big sage plant communities.

DEER:

Mule deer, Odocoeleus hemionus.
Common throughout District.

ANTELOPE:

Prong-horned antelope, Antilocapra americana.
Open rangelands habitat. Are found in Smith Creek Valley and the southern valleys of the District.

BIGHORN SHEEP:

Bighorn sheep, Ovis canadensis.
Uncommon in District, restricted to high mountain areas.

LIST OF BIRDS FOR TONOPAH AREA

LOONS

Common Loon

GREBES

Horned Grebe
Eared Grebe
Western Grebe
Pied-billed Grebe

PELICANS & CORMORANTS

White Pelican

HERONS AND ALLIES

Great Blue Heron
Common Egret
American Bittern
Black-crowned Night Heron
Snowy Egret
White-faced glossy Ibis

WATERFOWL

Whistling Swan
Canada Goose
White-fronted Goose
Snow Goose
Mallard
Gadwall
Pintail
Green-winged Teal
Blue-winged Teal
Cinnamon Teal
American Wigeon
Shoveler
Wood Duck
Redhead
Ring-neck Duck
Canvasback
Lesser Scaup
Common Goldeneye

Bufflehead
Ruddy Duck
Hooded Merganser
Common Merganser
Red-breasted Merganser

VULTURES, HAWKS & FALCONS

Turkey Vulture
Goshawk
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Swainson's Hawk
Rough-legged Hawk
Ferruginous Hawk
Golden Eagle

Marsh Hawk
Osprey
Prairie Falcon
Pigeon Hawk
Sparrow Hawk

GALLINACEOUS BIRDS

Blue Grouse
Sage Grouse
California Quail
Ring-necked Pheasant
Chukar Partridge
Hungarian Partridge
Snow Partridge

CRANES & ALLIES

Sandhill Crane
Virginia Rail
Sora Rail
American Coot

SHOREBIRDS

Killdeer
Common Snipe
Long-billed Curlew
Spotted Sandpiper
Solitary Sandpiper
Willet

Greater Yellowlegs
Western Sandpiper
American Avocet
Black-necked Stilt
Wilson's Phalarope
Northern Phalarope

GULLS, TERNS

California Gull
Ring-billed Gull
Forester's Tern
Caspian Tern
Black Tern

DOVES

Mourning Dove

OWLS

Screech Owl
Great Horned Owl
Burrowing Owl
Long-eared Owl
Short-eared Owl
Saw-Whet Owl

GOATSUCKERS

Poor-will
Nighthawk

SWIFTS

White-throated Swift
Vaux Swift

HUMMINGBIRDS

Costa's Hummingbird
Broad-tailed Hummingbird
Rufous Hummingbird
Calliope Hummingbird

KINGFISHERS

Belted Kingfisher

WOODPECKERS

Red-shafted Flicker
Lewis Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker

FLYCATCHERS

Eastern Kingbird
Western Kingbird
Ash-throated Flycatcher
Says Phoebe
Traill's Flycatcher
Western Flycatcher
Hammonds Flycatcher
Ducky Flycatcher
Gray Flycatcher
Wood Pewee
Olive-sided Flycatcher

LARKS

Horned Lark

SWALLOWS

Violet-green Swallow
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow

JAYS, MAGPIES & CROWS

Scrub Jay
Black-billed Magpie
Common Raven
Crow
Pinyon Jay
Clark's Nutcracker

CHICKADEES & ALLIES

Mt. Chickadee
Plain Titmouse
Bushtit

NUTHATCHES

White-breasted Nuthatch
Red-breasted Nuthatch

DIPPERS AND WRENS

Dipper
House Wren
Rock Wren
Long-billed March Wren
Canyon Wren

MOCKING BIRDS AND THREASHERS

Mockingbird
Brown Thrasher
Sage Thrasher

THRUSHES

Robin
Hermit Thrush
Swainson's Thrush
Western Bluebird
Mountain Bluebird
Townsend's Solitaire

KINGLETS & ALLIES

Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet
Water Pipit

WAXWINGS

Bohemian Waxwing
Cedar Waxwings

SHRIKES, STARLINGS

Northern Shrike
Loggerheaded Shrike
Starling

VIREOS

Solitary Vireo
Warbling Vireo

WARBLERS

Orange-crowned Warbler
Virginia's Warbler
Yellow Warbler
Myrtle Warbler
Audubon's Warbler
Black-throated Gray Warbler
Townsend's Warbler
Hermit Warbler
MacGillivray's Warbler
Yellowthroat
Yellow-breasted Chat
Wilson's Warbler

WEAVER FINCHES

House (English) Sparrow

BOBOLINKS, BLACKBIRDS & ORIOLES

Bobolink
Western Meadowlark
Yellow-headed Blackbird
Red-winged Blackbird
Scott's Oriole
Bullock's Oriole
Brewer's Blackbird
Common Grackle
Brownheaded Cowbird

TANAGERS

Western Tanager

GROSBEAKS, FINCHES, SPARROWS & BUNTINGS

Black-headed Grosbeak
Indigo Bunting
Lazuli Bunting
Evening Grosbeak
Cassins Finch
House Finch
Gray-crowned Rosy Finch

Pine Siskin
American Goldfinch
Lesser Goldfinch
Red Crossbill
Green-tailed Towhee
Rufus-sided Towhee
Lark Bunting
Savannah Sparrow
Grasshopper Sparrow
Vesper Sparrow
Lark Sparrow
Black-throated Sparrow
Sage Sparrow
Oregon Junco
Gray-headed Junco
Tree Sparrow
Chipping Sparrow
Brewer's Sparrow
Harris' Sparrow
White-crown Sparrow
White-throated Sparrow
Gold Crown Sparrow
Fox Sparrow
Lincoln's Sparrow
Song Sparrow

LIST OF FISH FOR TONOPAH AREA

TROUT:

Rainbow Trout, Salmo gairdneri
Found in many waters throughout the District. This introduced species is now the primary species planted in the District. Very important game fish.

Brown Trout, Salmo trutta
Found in many waters throughout the District. Introduced species that has been able to establish self sustaining populations in many streams throughout the District.

Brook Trout, Salvelinus frontinalis
Introduced game species found in many streams throughout the District. First plantings were prior to 1900.

PIKE:

Northern Pike, Esox lucius
Introduced into J.D. Reservoir, Eureka County. Excellent game fish.

CARP and MINNOWS:

Goldfish, Carassius auratus
Introduced into big Shipley Warm Springs, Eureka County, and into waters on the Blue Eagle Ranch, Nye County Non-game fish.

Carp, Cyprinus carpio
Introduced into Nevada in the 1880's. Can be found in the Reese River of the Humboldt River system. Non-game fish.

White River Spinedace, Lipidomeda albivallis
Found in Big Well area of Railroad Valley Wildlife Area, (introduced). Rare (Nevada Classification)
A non-game fish.

Tui Chub, Siphateles bicolor
Native to RR Valley where eight forms of this species have been collected. This non-game fish is also found in the Humboldt River System.

Lahontan Speckle Dace, Rhinichthys osculus velifer
Found in a spring in Caraco Lake Valley, Lander County.
Native to Humboldt River system. Non-game fish.

(Unclassified) Speckle Dace, Rhinichthys sp
Found in springs in Grass Valley - Lander County
Big Smoky Valley - Nye County
Monitor Valley - Nye County
Antelope Valley - Eureka County
This dace is endemic to the areas mentioned. Non-game fish.

Lahontan Redshiner, Richardsonius egregius
Planted in Lock's pond #2 and Upper Reese River.
Non-game fish.

SUCKERS:

Lahontan Mountainsucker, Pantosteus lahontan
Found in the Upper Reese River and Upper Reese River tributary streams. Native to Humboldt River system. Non-game fish.

Tahoe Sucker, Catostomus tahoensis
Probably found in the Upper Reese River. Native to Humboldt River system. Non-game fish.

CATFISH:

Brown Bullhead, Ictalurus nebulosus
Introudced into Flynn Pond, Eureka County. Game fish.

KILLIFISH:

Railroad Valley Springfish, Crenichthys nevadae
Endemic to hot springs in Railroad Valley. Rare (Nevada Classification). Non-game fish.

SUNFISH:

Bluegill, Lepomis macrochirus
Introudced into Big Well area of Railroad Valley Wildlife area, Nye County. Game fish.

Largemouth Blackbass, Micropterus solmoides
Some were planted in Fish Creek Springs (Little Smoky Valley) in 1952 - success unknown. Some largemouth were planted in Lock's Pond #2, Railroad Valley, Nye County. Game fish.

Black Crappie, Pomoxis nigromaculatus
Introduced into Fish Creek Springs (Little Smoky Valley)
Game Fish.

Amphibian and Reptile List
FOR TONOPAH AREA

Amphibians

Spadefoot Toads:

Great Basin Spadefoot, Scophiopus intermontanus
Ranges from sagebrush flats to mountainous areas throughout the District.

True Toads:

Boreal Toad, Bufo boreas boreas
Found in wet areas throughout the District.

Tree Frogs:

Pacific Treefrog, Hyla regilla
Chiefly a ground dweller found around low plant growth near water.

True Frogs:

Spotted Frog, Rana pretiosa
Occurs in springs, streams and ponds. Found in the northern portion of the District.

Red-legged Frog, Rana Aurora
Introduced into ponds on the Millett Ranch in Big Smoky Valley.

Leopard Frog, Rana pipiens
This frog frequents where there is permanent water and cattails. Found is suitable habitat throughout the State.

Bullfrog, Rana catesbeiana
Not many found in the District, probably due to the small amount of aquatic habitat in the District.

Reptiles

Lizards:

Zebra-tailed Lizard, Callisaurus draconodes
Frequents desert washes in the southern portion of the District.

Collared Lizard, Crotophytus collaris
A rock dwelling lizard that can be found in canyons and boulder strewn hillsides.

Long-nosed Leopard Lizard, Crotaphytus wislizenii widlizenii
Inhabits low areas such as valley bottoms. Avoids thickly vegetated areas.

Yellow-backed Spiny Lizard, Sceloporus magister uniformis
Found in many areas from shadscale deserts to canyon bottoms. Climbs rocks and trees and occasionally eats tree buds and leaves as well as insects.

Great Basin Fence Lizard, Sceloporus occidentalis bisriatus
One of the most common western lizards often seen in wooded and rocky places, around old buildings, woodpiles, fences and banks with rodent burrows. Found throughout the District.

Northern Sagebrush Lizard, Sceloporus graciosus graciosus
A ground dweller, usually found near bushes, logs, rocks or brush heaps. Occurs at high altitudes.

Northern Side-blotched Lizard, Uta stansburiana stansburiana
A desert species with a habitat of loose sand and scattered bushes and trees, Dirunal and very heat tolerant.

Northern Desert Horned Lizard, Phrynosoma platyrinos platyrhinos
Most widespread horned lizard in the District. Frequents shadscale, greasewood, sage and sandy areas. Found throughout the District. Commonly called "horny toad".

Skinks:

Great Basin Skink, Eumeces skiltonianus utahensis
Found in grassland, woodland, and forests, under logs, bark, rocks and other surface objects near streams and sometimes on dry hillsides far from water. Located in suitable habitats throughout entire District.

Whiptails:

Great Basin Whiptail, Cnedmidophorus tigris tigris
An active lizard of arid and semi-arid habitats occurring along gravelly washes, and in rocky places in sagebrush, grassland, and brushy foothill areas. Found in suitable habitats throughout the State.

Snakes:

Boas:

Rocky Mountain Rubber Boa, Charina bottae utahensis
Frequents grassland, woodland and forest in and beneath rotting logs. A rocky stream with banks of sand or loam in a coniferous forest is a favorable habitat. A good swimmer, burrower and climber.

Colubrids:

Western Yellow-bellied Racer, Coluber constrictor mormon
This snake favors open habitats of meadows, thin brush. Lives in semi-arid and moist environments. Avoids extremely dry areas and high mountains. Found in northern portion of District.

Red Racer Coachwhip, Masticophis flagellum piceus
Avoids dense vegetation and tolerates dry conditions - very swift snake. Found in the southern portion of District.

Desert Striped Whipsnake, Masticophis taeniatus taeniatus
A snake of brushlands, grasslands, sagebrush flats, pinyon-juniper to 9,400 feet. An alert, fast moving dirunal snake found throughout most areas of the District.

Mojave Patch-nosed Snake, Salvadora hexalepis mojavernsis
Found in the southern desert portion of the District. Very fast snake.

Great Basin Gopher Snake, Pituophis melanolencus deserticola
Occupies a great variety of habitats; cultivated fields, grass or brush are especially favored. The most common snake in the District; found throughout most of the District and the entire State of Nevada.

California Kingsnake, Lampropeltis getulus
Found in rocky canyons which have good vegetative cover. This snake is well thought of because part os its diet is other snakes. Found throughout most of the District.

Western Long-nosed Snake, Rincheilus lecontei lecontei
This snake inhabits valleys and foothills, but seldom occurs in the mountains. A good burrower, it spends its daylight hours underground. Found throughout most of the District.

Wandering Garter Snake, Thamnophis elegans vagrans
This snake has a variety of habitats from sea level to high mountains. Often in damp environments near water. Found wherever damp areas are found.

Western Ground Snake, Sonora semiannulata
Frequents sandy hillsides or flats, with or without rocks. Found under rocks or in sand hummocks to 6,000 feet. Located along the north edge of the District.

Nevada Shovel-nosed Snake, Chionactis occipitalis
Found in extreme southern part of district in dry sandy areas. Burrows into the sand for daytime protection and hunts insects at night.

Desert Night Snake, Hypsiglena torquata desserticola
Habitat consists mainly of sagebrush flats, deserts, lower slopes of mountains in both rocky and sandy areas. A nocturnal prowler feeding on lizards and frogs. Kills prey by injecting venom from rear enlarged grooved teeth of the upper jaw. Found throughout most of the District.

Vipers:

Great Basin Rattlesnake, Crotalus viridis lutosus
The Great Basin rattler frequents a variety of habitats. Found in many locations throughout the entire District.

Panamint Rattlesnake, Crotalus mitchelli stephensi
Found in the extreme southern part of dsitrict. Rough scales and sale and pepper speckling of this snake reminds one of the color decomposed granate.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action
GEOTHERMAL LEASING

2. Stages of implementation
EXPLORATION

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS: Airborne Exp.	ORV Travel	Rd & Trail Const.	Drilling/Seismographing	Rehabilitation	6. REMARKS
I. NONLIVING COMPONENTS						
A. AIR						
Exhaust by products	-X	-X	-X	-X	-X	= X = Insignificant
Particulate matter	0	-L	-M	-L	+M	
B. LAND						
Soil erosion	0	-H	-H	-L	+M	Values are for local impacts
Land use compatibility	0	-M	-M	-M	+L	Values are for local impacts
Land use suitability	0	-L	-M	-L	X	Values are for local impacts (X = Unknown)
Soil pollutants	0	X	-L	-M	+H	X = Insignificant
C. WATER						
Sediment load	0	-H	-H	-L	+M	
Chemical pollutants	0	-X	-X	-L	X	X = Insignificant
Temperature	0	0	0	-H	0	Localized impact
Radioactive pollutants	0	0	0	-X	0	X = Unknown
A. PLANTS *(Aquatic)*						
Vascular plants	0	-H	-H	-H	+L	Localized impact
Phytoplankton	0	-H	-H	-H	+L	
Floating	0	-H	-H	-H	+L	

inued on reverse)

	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	Airborne Exp.	ORV Travel	Rd & Trail Construction	Drilling/ Seismographing	Rehabilitation	REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*						
	Grasses, shrubs, forbs	0	-H	-H	-H	+H	Localized impact
			-L	-L	-L	-L	Area-wide impact
	C. ANIMALS *(Aquatic)*	0	-H	-H	-H	+L	Localized impact within habitat
	D. ANIMALS *(Terrestrial)*	X	-H	-H	-H	X	X = Insignificant
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES						
		0	-H	-H	-H	X	X = Unknown, Localized impact
		0	-L	-L	-L	X	Area-wide Impact
IV. HUM. VALUES	A. LANDSCAPE CHARACTER	0	-H	-H	-H	+L	Localized impact
		0	-L	-M	-L	+X	Area-wide Impact
							X = Insignificant
	B. SOCIOCULTURAL INTERESTS						
	Ed/Scientific	+M	0	0	+M	0	
	Cultural Values	0	-H	-H	-L	0	Localized Impact
	Social Welfare	+L	+L	+L	+L	0	

DISCRETE OPERATIONS

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however*, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing)*.
4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (–) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (–) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked *"O"* or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

GEOTHERMAL LEASING

2. Stages of implementation

DEVELOPMENT

3. DISCRETE OPERATIONS						
4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS					6. REMARKS
	Rd Construction & Improvement	Drilling Operations	Plant Construction & Development	Electric Distribution lines	Construction camp	
I. NONLIVING COMPONENTS						
A. AIR						
Exhaust Fumes & Hydrocarbon	-L	-L	-L	-L	-L	Short Term Impact
Other gases and vapors	-X	-M	X	X	X	Short Term impact
Particulate Matter	-H	-L	-M	-M	-H	Short Term Impact
B. LAND - LOCALIZED IMPACTS						
Soil Properties	-H	-H	-H	-L	-L	
Soil erosion	-H	-L	-H	-L	-L	
Geological Structure	0	X	0	0	0	X = Insignificant
Land Use compatibility	X	----------▶				sites unknown
Land Use suitability	X	----------▶				sites unknown
Soil Pollutant	X	-M	-M	0	-H	X = Insignificant
AREA WIDE IMPACT	-L	-L	-L	-L	-L	
C. WATER						
Dissolved solids	0	-L	-L	0	0	Localized impacts
Acid Balance	0	-L	0	0	0	
Temperature	0	-L	-L	-L	-L	
Chems Heavy Metals & Toxic Substances	0	-L	-L	0	0	
Coliform	0	0	0	0	-L	
Sediment Load	-H	-L	-H	X	-M	X = insignificant
A. PLANTS *(Aquatic)*	-H	-H	-H	-H	-H	Localized impact

nued on reverse)

	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	DISCRETE OPERATIONS: Rd Construction & Improvement	Drilling/ Operations	Plant Construction & Development	Electrical Distribution	Construction Camp	REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*	-H	----------	----------	----------	→	Localized Impact
	C. ANIMALS *(Aquatic)*	-H	----------	----------	----------	→	
	D. ANIMALS *(Terrestrial)*	-H	----------	----------	----------	→	Localized Impact
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES	-H	----------	----------	----------	→	Localized Impact
		-L	-L	-L	X	X	Areawide Impact
							X = Negligible
IV. HUM. VALUES	A. LANDSCAPE CHARACTER	-H	----------	----------	----------	→	Localized Impact
		-L	----------	----------	----------	→	Area-Wide Impact
	B. SOCIOCULTURAL INTERESTS						
	Local reg. structure	H					Impacts of development cannot
	Alts. & Expec.	X					be broken down by discrete
	Cult. Values	M					Operation
	Social Welfare	M					

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
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   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.).*
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages).*
3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation *(e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing).*
4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.
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   a. The measures of impact *(e.g. low, medium, and high)* are relative and their meaning may vary slightly from action to action. The term *"low"* should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a *"low"* rating. In cases like this, the impact will usually be marked *"O"* or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.
6. *Remarks* – Enter clarifying information.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action

GEOTHERMAL LEASING

2. Stages of implementation

OPERATIONS

4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	5. ANTICIPATED IMPACTS: Production	Maintenance	Waste Disposal	Expansion		6. REMARKS
I. NONLIVING COMPONENTS						
A. AIR						
Weather, Air Movement pattern	L	X	0	0		X = Insignificant
Temperature						
Particulate Matter	X	0	0	-L		X = Insignificant
Construction	X	X	X	X		Unknown.
Noxious & Toxic Gases	-X	X	X	-L		H_2S Etc., X = Unknown
B. LAND						
Soil Pollutant	-H	-M	-H	-M		(If unmitigated)
Soil erosion	-X	-L	X	X		X = Unknown, expected to be insignificant.
Geological structure	-H	0	X	X		Subsidence X = Unknown
Soil structure	0	-L	-L	X		X = Unknown
						data site specific
C. WATER						
Dissolved Solids	-H	-H	-H	X		These impacts would be
PH - Acid Balance	-H	-H	-H	X		dependent upon the characteristics
Temperature	H	H	-H	X		of existing waters.
Chemicals	-H	-H	-H	X		
Dissolved Oxygen	+L	-H	X	X		X = Unknown
A. PLANTS *(Aquatic)*	0	-H	X	X		X = Unknown

ued on reverse)

DISCRETE OPERATIONS: Production / Maintenance / Waste Disposal / Expansion

	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*	0	-L	H	-H		Localized Impacts
	C. ANIMALS *(Aquatic)*	0	-H	H	H		
	D. ANIMALS *(Terrestrial)*	H	-H	M	-H		All impacts specific
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES	X	----------▶				X = Unknown
							Site Specific
IV. HUM. VALUES	A. LANDSCAPE CHARACTER	X	0	H	L		X = insignificant
	B. SOCIOCULTURAL INTERESTS	+H	----------▶				

INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however*, it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.)*.
2. *Stages of Implementation* – Identify different phases of proposed project *(e.g. a road project consists of survey, construction, use, and maintenance stages)*.
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	DISCRETE OPERATIONS	Production	Maintenance	Waste Disposal	Expansion		
	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*	0	-L	H	-H		Localized Impacts
	C. ANIMALS *(Aquatic)*	0	-H	H	H		
	D. ANIMALS *(Terrestrial)*	H	-H	M	-H		All impacts specific
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES	X	----------		▶		X = Unknown Site Specific
IV. HUM. VALUES	A. LANDSCAPE CHARACTER	X	0	H	L		X = insignificant
	B. SOCIOCULTURAL INTERESTS	+H	----------		▶		

INSTRUCTIONS

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   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ANALYSIS WORKSHEET

1. Action
GEOTHERMAL LEASING

2. Stages of implementation
ABANDONMENT

3. DISCRETE OPERATIONS			Removal Phys. Plant	Surface Reclamation	Restoration		
	4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED		5. ANTICIPATED IMPACTS				6. REMARKS
I. NONLIVING COMPONENTS	A. AIR		-L			+H	
	B. LAND						
	Solid Waste		+H		+H		
	Soil Pollutants		0		+H		
	C. WATER						
	Sediment Load		-L			+H	
	Availability		X			0	X = Unknown
	A. PLANTS *(Aquatic)*		X			0	X = Unknown

ued on reverse)

	DISCRETE OPERATIONS	Removal Phys. Plant		Surface Reclamation	Restoration		
	COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED	ANTICIPATED IMPACTS					REMARKS
II. LIVING COMPONENTS (Con.)	B. PLANTS *(Terrestrial)*	-L			+M		
	C. ANIMALS *(Aquatic)*	X			X		X = Unknown Site Specific
	D. ANIMALS *(Terrestrial)*	X			X		
III. INTERRELATIONSHIPS	A. ECOLOGICAL PROCESSES	H			H		
IV. HUM. VALUES	A. LANDSCAPE CHARACTER	X			X		X = Unknown Site Specific
	B. SOCIOCULTURAL INTERESTS	H			H		

INSTRUCTIONS

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   a. Worksheet is normally used to analyze *"Anticipated Impacts"* of action; *however,* it may be used to analyze *"Residual Impacts."* Worksheets may also be used to compare impacts before and after mitigating measures are applied.
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   c. Assumptions may be made to establish a base for analysis *(e.g. estimated time periods, season of year, etc.).*
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APPENDIX B

The tabulation of lands in this appendix is an accurate description of those lands for which no leasing pending further environmental study and those lands for which special protective stipulations will be required. The maps which are a part of the EAR, due to scale effects, may be considered a pictorial representation of these areas which may contain minor inaccuracies. In any case this tabulation should be the sole basis for exclusions and special stipulations regarding lands to be leased.

These three (3) stipulations should be made part of all leases for geothermal development within the area treated by this EAR.

1. The lease area contains critical habitat for wild horses. Therefore, prior to entry on the lands, the lessee (operator) will discuss the proposed activities jointly with the Area Geothermal Supervisor and the District Manager who may require additional measures for the protection of the wild horses.

2. The certified statement required by Section 18 of the lease form must be completed by a qualified archaeologist, acceptable to the Authorized Officer.

3. Federally owned or controlled springs and water developments may be used only with the prior written approval of the Authorized Officer.

The following stipulations shall be made a part of all leases containing lands under the administration of the U.S. Forest Service:

It is mutually understood that some of the lands embraced in this lease have been inventoried as roadless areas and must be evaluated for their wilderness potential. Depending on the results of the evaluation, the areas in question may be determined as suitable for further wilderness study, or not suitable for wilderness. Those areas determined as suitable for wilderness may ultimately be classified as wilderness.

In the inventoried roadless areas, the following restrictions shall apply:

A. Existing roads, if any, may be used for temporary access in a non-destructive manner, but may not be reconstructed, improved or graded.

B. Where temporary access is needed to an area not served by an existing road, methods of access not resulting in erosion, scars or environmental damage shall be used.

C. Where long term access or development is desired, or where the method to be used will possibly cause environmental damage, an application for such access or development shall be filed with the Supervisor of the National Forest involved. Such application shall include the nature of the proposed access or development, any measures proposed to minimize the environmental impact, including proposed restoration measures, and a map of the location and the access or development. The Supervisor will

coordinate the proposal with the local office of the United States Geological Survey, and based upon such coordination and agreement reached with the United States Geological Survey, will either approve the proposal, conditioned upon necessary protective measures, or will disapprove the proposal.

D. This clause shall become inoperative in the event the area is determined as not suitable for wilderness.

E. If the area, or part of it, is determined as suitable for wilderness study, this clause shall remain in full force and effect until the area is either classified for wilderness or is formally rejected for such classification. If the area is classified as wilderness, this lease shall become subject to the provisions of the Act of September 3, 1964, 78 Stat. 893, and the Forest Service regulations and policies pertaining thereto.

The following legal descriptions outline those areas requiring additional Environmental Study prior to leasing for geothermal resources. Therefore, no leases for geothermal resources should be issued for these areas at the present time.

T. 6N. R. 52E. 13, 12

T. 6N. R. 53E. 7, 18

T. 7N. R. 53E. 20,21,28,29

T. 7N. R. 53E.

N 1/2	14	S 1/2NE 1/4	4
	15		16
	12		
	11		
	10		
E 1/2	9		
	2		
	3		

T. 4N. R. 41E. 1, E 1/2 2

T. 4N. R. 42E. W 1/2 6

T. 5N. R. 41E. S 1/2 25, SE 1/4 26, E 1/2 35, 36

T. 5N. R. 42E. W 1/2 30, W 1/2 31

T. 7N. R. 46 1/2E. 1, 12

T. 7N. R. 47E. 4-10, W 1/2 15, 16

T. 8N. R. 50E. 1, NE 1/4 2, N 1/2SE 1/4, NE 1/4SW 1/4 N 1/2NW 1/4, SE 1/4NW 1/4, 2

T. 8N. R. 51E. N 1/2 6

T. 9N. R. 47E. 1, 2, 11-14

T. 9N. R. 47 1/2E. 1, 12,13,24

T. 9N. R. 48E. 5-7, 18

T. 9N. R. 50E.	1, E 1/2E 1/2SE 1/4 & SE 1/4SE 1/4 NE 1/4 2, (those lands east of the road in north six mile canyon); E 1/2E 1/2NE 1/4 & E 1/2NE 1/4SE 1/4 & SE 1/4SE 1/4 S 11 (those lands east of the road in north six mile canyon); 12, 13, E 1/2NE 1/4 & E 1/2NW 1/4SE 1/4 & SW 1/4SE 1/4 14; E 1/2 23; 24, 25, E 1/2W 1/2 & E 1/2 26; 35, 36
T. 9N. R. 51E.	S 1/2N 1/2 & S 1/2 6; W 1/2W 1/2SW 1/4 5; 7; NW 1/4 & SW 1/4 & W 1/2SE 1/4SE 1/4 8; 18; W 1/2NE 1/4 & W 1/2SE 1/4 & W 1/2 17, 19; 20; W 1/2W 1/2 28; 29, 30, 31; NE & NW & SW SW 1/4 & NW 1/4 & NE 1/4 & NE 1/4 SE 1/4 32; W 1/2NW 1/4 33
T. 10N. R. 40E.	1, N 1/2 12
T. 10N. R. 41E.	N 1/2 1, 2, N 1/2 3, 6, N 1/2 7
T. 10N. R. 42E.	2-4, N 1/2 5, N 1/2 6, N 1/2 9, 10, 11, N 1/2 15
T. 10N. R. 47E.	1-3, 10-14, 23-26, 35, 36
T. 10N. R. 47 1/2E.	ALL
T. 10N. R. 48E.	7-10, 15-22, 27-32
T. 10N. R. 45E.	N 1/2 2, N 1/2 3, N 1/2 4, N 1/2 5
T. 10 1/2N. R. 41E.	ALL
T. 11N. R. 40E.	S 1/2 24, 25, 36
T. 11N. R. 41E.	1, 2, S 1/2 10, 11-17, 19-36
T. 11N. R. 42E.	W 1/2 2, 3-10, W 1/2 11 W 1/2 14, 15-23, 26-35
T. 11N. R. 44E.	13, 24, 25, 36
T. 11N., R. 44 1/2E.	ALL

T. 11N. R. 45E.	W 1/2 2, 3, 4, 5 all except SE 1/4SE 1/4, 6 all except S 1/2SE 1/4, 7 - W 1/2 & S 1/2SE 1/4, 8 - NW 1/4NE 1/4, 9-11, 14-16, 17-NE 1/4 NE 1/4 & S 1/2SE 1/4, 18 W 1/2 & NW 1/4NE 1/4, 19 N 1/2NW 1/4, 20-NE 1/4& S 1/2SW 1/4, 21 - 23, W 1/2 24, 25-28, 29-N 1/2NE 1/4 & SE 1/4SE 1/4, 30-W 1/2 & SE 1/4 31, 32-W 1/2 & SE 1/4 & NE 1/4NE 1/4, 33 - 36
T. 11N. R. 47E.	1 - 3, 9 -16, 21 - 28, 33 - 36
T. 11N. R. 48E.	2-11, 14-23, 26-35
T. 12N. R. 41E.	S 1/2 1, SE 1/4 11, 12, 13, E 1/2 & SW 1/4 14, 23 - 26, E 1/2 27, E 1/2 34, 35, 36
T. 12N. R. 42E.	4-9, 16-21, W 1/2 27, 28 - 33, W 1/2 34
T. 12N. R. 47E.	SW 1/4 22, S 1/2 23, 25, 26 S 1/2 & NE 1/4 27, 34 - 36
T. 12N. R. 48E.	30 - 35
T. 2N. R. 55E.	1-4, 9-16, 21-28, 33-36
T. 3N. R. 55E.	1; 12-16, 21-28, 33-36
T. 4N. R. 55E.	36
T. 3N. R. 56E.	1-12, 18, 19, 30, 31
T. 4N. R. 56E.	13-16, 21-28, 31-36
T. 4N. R. 57E.	1-3, 10-12, 15-22, 27-34
T. 5N. R. 57E.	1-3, 10-15, 22-27, 34-36
T. 5N. R. 58E.	5-8, 17-20, 29-32
T. 6N. R. 57E.	12, 13, 24-27, 34-36

T. 6N. R. 58E.	1-4, 7-12, 17-20, 29-32
T. 7N. R. 58E.	3-5, 8-10, 13-17, 20-29, 32-36
T. 8N. R. 58E.	8, 9, 16, 17, 20, 21, 28, 29, 32-34
T. 13N. R. 42E.	3-10, 15-20, 28-30
T. 14N. R. 42E.	1, 2, 10-16, 21-23, 26-29, 32-34
T. 14N. R. 43E.	6, 7
T. 15N. R. 42E.	1, 2, 11-14, 23-26, 35, 36
T. 15N. R. 43E.	2-10, 15-21, 29-32
T. 16N. R. 42E.	1, 2, 11-14, 23-26, 35, 36
T. 16N. R. 43E.	6, 7, 18, 19, 28-34
T. 17N. R. 42E.	E 1/2 35, 36
T. 19N. R. 44E.	7-18
T. 19N. R. 45E.	7, 17-22, 27-29
T. 16N. R. 46E.	27-29, 32-34
T. 13N. R. 46E.	3, 4, 9, 10, 15, 16
T. 14N. R. 46E.	14, 15, 22, 23, 26-28, 33, 34
T. 15N. R. 46E.	25, 26, 35, 36
T. 13N. R. 49E.	2-11, 15-17, 20-22
T. 13 1/2N. R. 49E.	20-29, 31-35
T. 13 1/2N. R. 50E.	19
T. 14N. R. 49E.	1-17, 20-29, 31-36
T. 14N. R. 50E.	5-8, 17-20, 30
T. 15N., R. 49E.	12, 13, 15-22, 24, 25, 27-36
T. 15N. R. 50E.	7, 18, 19, 30-32

T. 18N. R. 49E.	E 1/2 20, 21, 22, 24, 25, 27, 28, E 1/2 29, 36
T. 17N. R. 49E.	1, 2, 11, 12
T. 17 1/2N. R. 49E.	1, 2, 11, 12
T. 17N. R. 50E.	2-11, 15-22, W 1/2 23, N 1/2 27, 28-30
T. 18N. R. 50E.	29, S 1/2 30, 31-33, S 1/2 34, S 1/2 35

The following described lands have been identified in USFS Planning as having particularly unstable soils that have high erosive potentials. It is felt that the leasing would be acceptable in these areas, but that it will be necessary to formulate stipulations on a case by case basis. Therefore, it is recommended that no leasing be done in these areas at present and that at such time as application should be made to lease these lands, studies will be made to determine the stipulations that may be required.

T. 12N. R. 37E.	1, 2
T. 12N. R. 38E.	W 1/2 5, 6
T. 13N. R. 37E.	1, 2, 11-14, 23-27, 35, 36
T. 13N. R. 38E.	W 1/2 5, 6, 7, W 1/2 8, W 1/2 17, 18-20, 29-32
T. 13N. R. 39E.	1-3, 10-15
T. 14N. R. 39E.	1, 2, 11-15, 22-27, 34-36
T. 14N. R. 40E.	3-8, 17-19, 30, 31
T. 15N. R. 39E.	25, 36
T. 15N. R. 40E.	1-4, 8-36
T. 15N. R. 41E.	6, 19
T. 16N. R. 40E.	34-36
T. 16N. R. 41E.	4-8, 10, 15, 16, 18, 20-22, 27-29, 31-33
T. 12N. R. 45E.	11-14, 23-26
T. 12N. R. 46E.	7, 18
T. 13N. R. 45E.	13-16, 21-28, 33-36
T. 14N. R. 45E.	1
T. 14N. R. 45 1/2E.	1, 12
T. 14N. R. 46E.	4-9, 14

T. 14N. R. 47E.	6, 7
T. 15N. R. 45E.	25, 36
T. 15N. R. 45 1/2E.	12, 13, 24, 25, 36
T. 15N. R. 46E.	5-8, 17-20, 24, 27-34
T. 15N. R. 47E.	30, 31
T. 16N. R. 46E.	25, 36
T. 16N. R. 47E.	30, NW 1/4 31
T. 13N. R. 48E.	1-3, 10, 11, 14, 15
T. 13N. R. 50E.	W 1/2 4
T. 13 1/2N. R. 48E.	25, 34-36
T. 13 1/2N. R. 49E.	19, 30
T. 14N. R. 48 1/2E.	12, 13, 24, 25, 36
T. 15N. R. 48E.	1, 2, E 1/2 4, 11-13
T. 15N. R. 49E.	3-6, 7-11, 14, 23, 26
T. 16N. R. 48E.	1, 4, 9, 13, 16, 21, 25, 28, 34-36
T. 16N. R. 49E.	2-11, 14-22, 28-33
T. 17N. R. 48E.	3, 10, 13, 14, 16, 17, 21, 23-25, 27, 28, 34, 36
T. 17N. R. 49E.	26, S 1/2 27, 31-35
T. 17 1/2N. R. 48E.	3, 10
T. 18N. R. 49E.	21-23, 26-28, N 1/2 34, N 1/2 35

No leasing is recommended for the areas listed below. They consist of a Research Natural Area which has been designated by the US Forest Service as a "no surface use area" and McCan Canyon "geologic" area which is "an area of fragile scenic beauty".

Mt. Jefferson Research Natural Area

T. 11N. R. 45E.	5	SW 1/4SW 1/4
	6	S 1/2SE 1/4
	7	NE 1/4
		N 1/2SE 1/4
	8	S 1/2NE 1/4
		NE 1/4NE 1/4
		S 1/2NW 1/4
		NW 1/4NW 1/4
		SW 1/4
		N 1/2SE 1/4
		SW 1/4SE 1/4
	17	S 1/2NE 1/4
		NW 1/4NE 1/4
		W 1/2
		N 1/2SE 1/4
	18	S 1/2NE 1/4
		NE 1/4NE 1/4
		SE 1/4
	19	E 1/2
		S 1/2NW 1/4
		SW 1/4
	20	W 1/2
		N 1/2SE 1/4
	29	W 1/2
		S 1/2NE 1/4
		N 1/2SE 1/4
		SW 1/4SE 1/4
	30	NE 1/4
	32	NW 1/4NE 1/4
		S 1/2NE 1/4

McCan Canyon Geologic Area

T. 7N. R. 47E.	6	N 1/2NW 1/4
T. 8N. R. 47E.	29	SW 1/4
	30	SW 1/4NE 1/4
		S 1/2NW 1/4
		S 1/2
	31	ALL
	32	NW 1/4NW 1/4

The following described lands contain lands that have been identified as critical habitat for the mating, nesting, and brood rearing of sage grouse. Therefore, prior to entry onto the lands, the lessee (operator) will discuss the proposed activity with the Authorized Officer and the Geological Survey. They may require additional measures for the protection of the sage grouse which may include:

1. No surface occupancy on the actual strutting grounds.

2. Restriction of activity during the months of April through July in brood rearing areas.

R. 39E. T. 10N.	24, 13, 12, 1
R. 39E. T. 11N.	36, 25, 24
R. 40E. T. 10N.	19-21, 15-18, 11-7, 2-6
R. 40E. T. 11N.	31-35, 26-30, 19-23, 15-18
R. 45E. T. 8N.	15, 16, 17, 8-12, 1-5
R. 45E. T. 9N.	32-36, 23-28, 9-12, 1-5
R. 45E. T. 10N.	20-36, 13-17, 8-11, S 1/2 4
R. 46E. T. 9N.	30, 19, 11-14, 2-8
R. 46E. T. 10N.	26-35, 15-22, 10, 2, 3, NE 1/4 4
R. 46E. T. 11N.	33, 34
R. 47E. T. 9N.	29-32
R. 47E. T. 11N.	3-10
R. 47E. T. 12N.	31-34

R. 49E. T. 10N.	N 1/2 33, 28, 29, W 1/2 22 W 1/2 21, 20, 16, 17 8-10, 3-5
R. 49E. T. 11N.	27-29, 32-34 3, 4, 9, 10
R. 49E. T. 12N.	35, 36 11, 12, 1, 2
T. 17N. R. 48E.	13, 24, 25, 36
T. 17N. R. 49E.	31, 32
T. 16N. R. 49E.	5-8

The following described lands have been identified as critical Bighorn sheep habitat. Therefore, prior to entry onto the lands the lessee (operator) will discuss the proposed activity with the Authorized Officer and Geological Survey. They may require additional measures for the protection of the Bighorn Sheep which may include:

1. Limitations on surface occupancy during periods of critical Bighorn Sheep use.

2. Siting of improvements so as to provide minimum disturbance of Bighorn Sheep habitat and forage.

T. 9N. R. 42E.	W 1/2 1, 2-6, 8-11, W 1/2 12, W 1/2 13, 14-17, 21-23, W 1/2 24, W 1/2 25 26, 27, 34, 35
T. 10N. R. 40E.	1, 12
T. 10N. R. 41E.	1-18, 23-25
T. 10N. R. 42E.	1-35, W 1/2 36
T. 10N. R. 43E.	W 1/2 6, W 1/2 7, W 1/2 18
T. 10 1/2N. R. 41E.	1-6
T. 11N. R. 40E.	24, 25, 36
T. 11N. R. 41E.	1-3, 9-17, 19-36
T. 11N. R. 42E.	ALL
T. 11N. R. 43E.	W 1/2 18, W 1/2 19, W 1/2 30, W 1/2 31
T 12N. R. 41E.	1, 11-14, 22-27, 34-36
T.12N. R. 42E.	W 1/2 2, 3-10, SW 1/4 14, 15-23, SW 1/4 24, W 1/2 25, 26-36

T. 13N. R. 41E.	25-36
T. 13N. R. 42E.	2-4, 8-11, 14-22, W 1/2 23, W 1/2 26, 27-34, W 1/2 35
T. 5N. R. 47E.	1-4, N 1/2 9, N 1/2 10, N 1/2 11, SE 1/4 11, 12-14, E 1/2 22, 23, 24, 26 NE 1/4 27, S 1/2 27, SE 1/4 28, NE 1/4 33, N 1/2 34, N 1/2 35
T. 6N. R. 57E.	S 1/2 10, SE 1/4 12, E 1/2 13, W 1/2 14, 15, E 1/2 16, 20-22 NE 1/4 24, S 1/2 24, 25-29, 32-36
T. 5N. R. 58E.	5-8, S 1/2 9, 16-19 N 1/2 20, N 1/2 30
T. 6N. R. 58E.	S 1/2 7, S 1/2 8, 17-20 29-32

The following described lands contain unstable/highly erodible soils. Therefore, prior to entry onto the lands, the lessee (operator) will discuss the proposed activities jointly with the Area Geothermal Supervisor and the District Manager who may require additional measures for the protection of the soils. Such measures may include:

1. No surface occupancy of selected areas.

2. Restriction on surface entry during periods of excessive runoff.

3. Special reclamation techniques.

T. 11N. R. 52E.	4, 5, 8, 9, 16-20, 30, 31
T. 11N. R. 51E.	3, 4, 9, 10, 13-15, 21-28, 31, 32, 36
T. 10N. R. 52E.	7, 18-20, 29-31
T. 10N. R. 51E.	7, 11-14, 23-26, 35, 36
T. 9N. R. 52E.	6, 7, 18, 19, 30, 31
T. 9N. R. 51E.	1, 12-15, 22-25, 36

The following described lands have been identified as critical deer habitat. Therefore, prior to entry onto the land the lessee (operator) will discuss the proposed activity with the Authorized Officer and the Geological Survey. They may require additional measures for the protection of the deer which may include:

1. Limitation on surface occupancy during periods of critical deer use.

2. Siting improvements so as to provide minimum disturbance of deer habitat and forage.

R. 49E. T. 1N.	1, 2, 11, 12, 13, 14, 23, 24, 25 NE 1/4 26
R. 49E. T. 2N.	S 1/2 36
R. 50E. T. 1N.	5, 6, 7, 8, 17, 18, 19, 20, W 1/2 21, W 1/ 2 28, 29, 30
R. 50E. T. 2N.	31, SW 1/4 32

T. 3N. R. 45E.	1-17, 20-28, 35, 36
T. 3N. R. 46E.	1-20, 29, 30, 31
T. 3N. R. 47E.	5-8, 17, 18
T. 4N. R. 44E.	13, 24, 25, 36
T. 4N. R. 45E.	1-4, 7-36
T. 4N. R. 46E.	ALL
T. 4N. R. 47E.	4-9, 16-21, 28-32
T. 5N. R. 45E.	1, 2, 11-14, 23-26, 34-36
T. 5N. R. 46E.	ALL

T. 5N. R. 47E.	2-11, 14-23, N 1/2 & SW 1/4 26, 27-35
T. 8N. R. 47E.	1, 2, E 1/2 3, E 1/2 10, 11-14, NE 1/4 15, E 1/2 23, 24
T. 9N. R. 47E.	25, 26, E 1/2 34, 35, 36
T. 8N. R. 47 1/2E.	1, 12, 13, 24
T. 9N. R. 47 1/2E.	25, 36
T. 8N. R. 48E.	1-13, 16-21
T. 9N. R. 48E.	S 1/2 19, S 1/2 28, 29-34, S 1/2 35
T. 8N. R. 49E.	S 1/2 6, 7, 18
T. 9N. R. 51E.	NE 1/4, E 1/2SE 1/4 8; 9; E 1/2NE 1/4 & E 1/2 SE 1/4 17; 16, 21, E 1/2 & E 1/2W 1/2 28
T. 11N. R. 42E.	1, 12, 13
T. 11N. R. 43E.	6, 7, 18

The following described lands contain live waters that are critical to the survival of waterfowl and are important fish habitat. Therefore, prior to entry onto the lands, the lessee (operator) will discuss the proposed activities jointly with the Area Geothermal Supervisor and the District Manager who may require additional measures for the protection of the water and its environment. Such measures may include:

1. No use of the water.

2. No surface occupancy on some or all of the adjacent lands within one-quarter (1/4) mile of the water.

3. Limitations on the type of equipment that may be used.

4. Restriction of activities during certain times of the year.

All lands under the administration of the US Forest Service.

Lands within the Railroad Valley Wildlife Management Area which are described in the withdrawal order as follows:

Mount Diablo Meridian

T. 9N. R. 50E.	Sec. 34, S 1/2; Sec. 35, S 1/2
T. 8N. R. 50E.	Sec. 1, SW 1/4; Secs. 2,3,10,11, and 16; Sec. 9, E 1/2; Sec. 12, NW 1/4; Sec. 16, E 1/2; Sec. 18, S 1/2SW 1/4; Sec. 19, S 1/2
T. 9N. R. 57E.	Sec. 33, S 1/2; Sec. 34, S 1/2
T. 8N. R. 57E.	Secs. 3,4,9, and 16: Sec. 2, NW 1/4,N 1/2SW 1/4,SW 1/4SW 1/4; Sec. 10, N 1/2, SW 1/4; Sec. 11, W 1/2NW 1/4, NE 1/4NW 1/4 Sec. 15, W 1/2

T. 8N. R. 55E.	Sec. 13, S 1/2S 1/2; Sec. 14, S 1/2S 1/2; Sec. 23, N 1/2; Sec. 24
T. 7N. R. 55E.	Secs. 15, 16, 21 and 28; Sec. 22, W 1/2; Sec. 27, W 1/2
T. 12N. R. 47E.	NE 1/4 20, NW 1/4 19 SW 1/4 17, SE 1/4 18
T. 13N. R. 47E.	SW 1/4 & NW, SE 1/4, & NW 1/4 S9 W 1/2 16, E 1/2 17, 20, 29
T. 9N. R. 49E.	W 1/2 15, E 1/2 16
T. 10N. R. 49E.	E 1/2 22, SE 1/4 15
T. 3N. R. 52E.	3

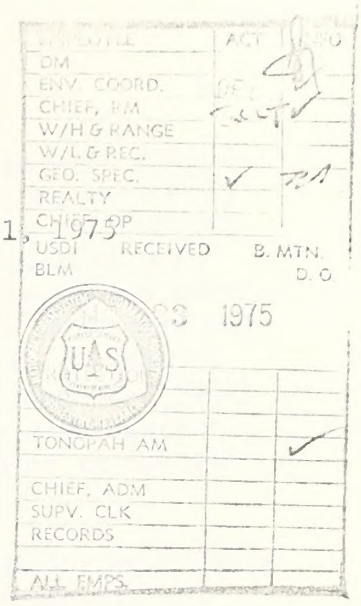
APPENDIX C

LETTERS AND COMMENTS ON THE ROUGH DRAFT OF THE TONOPAH GEOTHERMAL ENVIRONMENTAL ANALYSIS RECORD

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Toiyabe National Forest
111 No. Virginia St., Rm. 601
Reno, Nv. 89501

2800

May 21, 1975



Gene Nodine, District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain Nv. 89820

Dear Mr. Nodine:

This is to relate to you our comments concerning the "Regional Environmental Analysis on Geothermal Leasing in the Tonopah Resource Area." Our copy is being passed on to our Regional Office in Ogden, Utah.

The District Forest Rangers (Austin and Tonopah) participated in the report preparation and have no comments. It is understood that there will be Forest Service review of the Notices of Intent and the USGS Environmental Impact Analysis.

Comments by members of the Supervisor's Office are attached. We appreciate this and future opportunities in coordinating land management with respect to Geothermal development.

Sincerely,

Hugh Pangman

HUGH PANGMAN
Deputy Forest Supervisor

Enclosure

COMMENTS OF TOIYABE NATIONAL FOREST
ON GEOTHERMAL E.A.R. FOR THE TONOPAH
RESOURCE AREA

1. The report is a good analysis of how Geothermal Leasing will affect the local environments where the exploration and drilling will occur. However, little attention is given to the overall goals and impacts. There is no perspective of the projected magnitude of leasing in Central Nevada as a whole. The long-run influx of workers and service-oriented people will certainly have impacts beyond the wellheads and powerplants. Where will the generated power go? If it is used in Central Nevada, how will the area be affected in the long-run? Will there be a "boom" effect such as occurred with energy development in other places? Introduction of industrial development in Central Nevada could have great socio-economic ramifications.

2. Future E.A.R.'s (or USGS E.I.A.'s) should be developed for each lease on National Forest lands and these should provide a framework for evaluating operation plans. These should be tied in closely with the Central Nevada Land Use Plan and Forest Service personnel.

3. More rationale should be presented as to why an E.I.S. is not necessary (re., the Black Rock Desert controversy).

4. The Arc Dome Candidate Wilderness area should be in the "No Leasing" category (like Mt. Jefferson and McCann Canyon). The geological structure suggests that there is probably no Geothermal potential there and this area is classified for "retention" in the Central Nevada Land Use Plan. As per recent court decision, we cannot withdraw it from mineral entry until it is designated wilderness, but we can withhold it from leasing. Otherwise, we may be opening ourselves up to "nuisance claims" in a future wilderness.

5. There is no treatment of what will happen to existing hot springs (valuable for recreation and livestock watering).

6. There should be more summary analysis as to projections of how long the wells will produce. Whether the resource will last 20-50 years or for the "forseeable future" will have a great effect on environmental and economic costs/benefits. This is hard to predict, but the consequences certainly merit discussion.

In summary, we support Geothermal development as an energy alternative. The overall effects should be an enhancement to the environment when compared to other energy sources. However, this is true only if the resource is sustainable in perpetuity and other values are protected.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Toiyabe National Forest
111 No. Virginia St., Rm. 601
Reno, NV 89501

2800

May 29, 1975

Gene Nodine, District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain, NV 89820

Dear Mr. Nodine:

In reference to our comments concerning the "Regional Environmental Analysis on Geothermal Leasing in the Tonopah Resource Area" (comments transmitted May 21, 1975), we would like to make a change.

Please amend the comments by deleting paragraph #4. This action is in accordance with discussions including Ted Holland and ranger district personnel. The Arc Dome Wilderness Study Area (map enclosed) thus remains as an area requiring additional environmental study prior to geothermal leasing. We request that the restrictions which apply to roadless areas (as written by the Humboldt National Forest) be substituted for paragraph #4.

Sincerely,

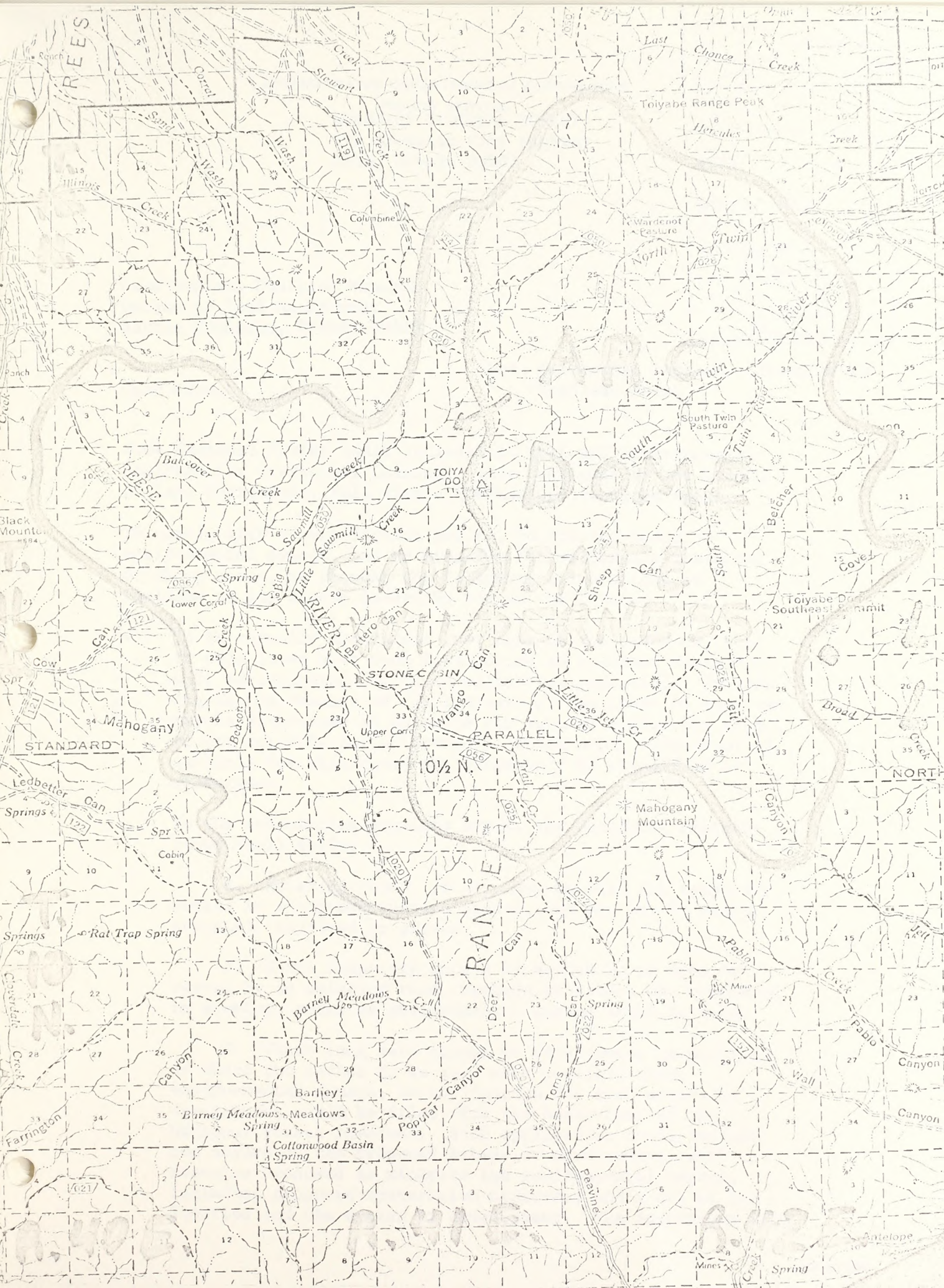
HUGH PANGMAN
Deputy Forest Supervisor

Enclosure

EMPLOYEE	ACT	INFO
DM		
ENV. COORD.	✓	
CHIEF, RM		
W/H & RANGE		
W/L & REC.		✓
GEO. SPEC.		
REALTY		
CHIEF, OP		

USDI BLM RECEIVED JUN 4 1975 B. MTN D. O.

PROTECTION		
SHO-EUR. AM		
TONOPAH AM		✓
CHIEF, ADM		
SUPV. CLK		
RECORDS		
ALL EMPS.		


T 10½ N.
STONE CABIN
Toiyabe Range Peak
Mahogany Mountain
Mahogany
Barley
Barley Meadows
Barley Meadows Spring
Cottonwood Basin Spring
Rat Trap Spring
Lower Corral
Upper Corral
Cabin
Spring
Creek
Canyon
Wash
Sand Wash
Stewart Creek
Last Chance Creek
Hercules Creek
Illinois Creek
Columbine
Wardecot Pasture
North Twin River
South Twin River
South Twin Pasture
Belcher Creek
Sheep Can
Bakeover Creek
Sawmill Creek
Big Little Reese River
Bellero Can
Wrango Can
Deer Can
Toms Can
Peavine
Popular Canyon
Pablo Canyon
Broad Canyon
Wall Canyon
Ledbetter Can
Cow Can
Farrington
Chimney Creek
Antelope Spring
Mines
Toiyabe Dome
Southeast Summit
Black Mountain
Standard
Parallel
North

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
HUMBOLDT NATIONAL FOREST
976 Mountain City Highway
Elko, Nevada 89801

DM
ENV. COORD.
CHIEF, PM
W/L & RANGE
W/L & REC.
GEO. SPEC.
REALTY
CHIEF, OP
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2820 MAY 8 1975
PROTECTION
SHO-EUR. AM
TONOPAH
CHIEF SUPV. RECORDS
ALL EMPS.

May 5, 1975

Gene Nodine, District Manager
Bureau of Land Management
Battle Mountain, Nevada 89820

Re: Geothermal Leasing - Inventoried Roadless Areas

Dear Gene:

Some National Forest lands included in Regional Environmental Analyses for Geothermal Leasing, being developed by the Bureau of Land Management, fall within inventoried roadless areas.

To comply with Forest Service policy, to prevent undue environmental damage, and to preserve the wilderness character of these areas, we request the following stipulations be included in any leases issued by you in the future:

It is mutually understood that some of the lands embraced in this lease have been inventoried as roadless areas and must be evaluated for their wilderness potential. Depending on the results of the evaluation, the areas in question may be determined as suitable for further wilderness study, or not suitable for wilderness. Those areas determined as suitable for wilderness may ultimately be classified as wilderness.

In the inventoried roadless areas, the following restrictions shall apply:

A. Existing roads, if any, may be used for temporary access in a non-destructive manner, but may not be reconstructed, improved or graded.

B. Where temporary access is needed to an area not served by an existing road, methods of access not resulting in erosion, scars or environmental damage shall be used.

C. Where long term access or development is desired, or where the method to be used will possibly cause environmental damage, an application for such access or development shall be filed with the Supervisor of the National Forest involved. Such application shall include the nature of the proposed access or development, any measures proposed to minimize the environmental impact, including proposed restoration measures, and a map of the location and the access or development. The Supervisor will

coordinate the proposal with the local office of the United States Geological Survey, and based upon such coordination and agreement reached with the United States Geological Survey, will either approve the proposal, conditioned upon necessary protective measures, or will disapprove the proposal.

D. This clause shall become inoperative in the event the area is determined as not suitable for wilderness.

E. If the area, or part of it, is determined as suitable for wilderness study, this clause shall remain in full force and effect until the area is either classified for wilderness or is formally rejected for such classification. If the area is classified as wilderness, this lease shall become subject to the provisions of the Act of September 3, 1964, 78 Stat. 893, and the Forest Service regulations and policies pertaining thereto.

Thank you for your cooperation.

Sincerely,

VERN L. THOMPSON
Forest Supervisor

UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Area Geothermal Supervisor
Conservation Division
345 Middlefield Road
Menlo Park, California 94025

GEO. SPEC. ✓ 7-2
REALTY
CHIEF, OP
USDI RECEIVED B. MTN.
BLM D. O.
APR 30 1975
PROTECTION
SHO-EUR. AM
CHIEF, ADM
SUPV. CLK
RECORDS
ALL EMPS.

April 28, 1975

Memorandum

To: District Manager, Bureau of Land Management, Battle Mountain, Nevada

From: Area Geothermal Supervisor

Subject: Review of Draft EAR, Tonopah Resource Area, Nevada

Although we regret that we have not had an opportunity to participate in a joint field inspection of the Tonopah Resource Area, we are pleased to have the opportunity to review the draft EAR.

The draft is, in general, very well prepared and comprehensive. We hope the following comments and suggestions contained in Attachment A (Comments and Recommendations) will be of value in the preparation of the final EAR.

A copy of the latest draft of GRO Order No. 4(dated 2/26/75) is enclosed as Attachment B for your use only and not for publication.

Reid T. Stone

ATTACHMENT A

COMMENTS & RECOMMENDATIONS EAR
TONOPAH RESOURCES AREA No. 27-060-5-30

We recommend a more concise (page size) location map to supplement the pocket maps. A small-scale map of Nevada, with the subject area outlined, would be adequate.

The legend for the enclosed maps is obscure in its location at the end of the report. We suggest that the legend be included in the map margin, or on the map pocket.

Description of Existing Environment seems very good, in general. The stratigraphic chart (pg. 13) is illegible, clear copies of this chart should be available for the final EAR.

Geochemistry is discussed in one paragraph (pg. 16), but is not applied to thermal springs or wells in the area. This paragraph could be deleted without significant loss to the report. Alternatively, the results of chemical geothermometry could be cited for one or two prominent springs in the area.

Description of Proposed Action could include a brief summary of alternative or complementary uses of geothermal energy, such as space heating, food and mineral processing, with emphasis on uses which might be particularly well adapted to the area.

Page 37, Exploration. The last sentence, second paragraph under LAND: "Roads and trails (and drill pads) constructed upon steep mountain slopes are particularly susceptible to erosion." In steep terrain they may also be susceptible to landslides or other types of slope failure.

Page 38, Exploration. First sentence: "This use" should be spelled out geothermal development.

Page 45, Anticipated Impacts (3). The mining industry is of economic importance to the area. The section on Anticipated Impacts could include a brief statement of probable positive impact on enhancement to the mining industry through availability of potentially cheaper sources of energy for mining and treatment.

Comments on the Recommended Mitigating Measures Section A General (page 52), are as follows:

1. Acceptable.

2. Add: approved by the surface management agency and Area Geothermal Supervisor. Delete: "30 days prior to commencing construction."

3. Acceptable.

4. Recommend deletion, covered by 30 CFR 270.34 Plan of Operations requiring joint USGS-BLM approval.

5. Only if determined to be necessary by the Area Geothermal Supervisor and Authorized Officer pursuant to a Plan of Operation (30 CFR 270.34).

6. Restoration is covered by GRO Order No. 4 (Pollution Protection paragraph No. 4) and is enforced by the Area Geothermal Supervisor after consultation with BLM.

7. Acceptable.

8. Noise Standards of 65dB(A) at ½ mile from the source are imposed by GRO Order No. 4 (Noise Criteria) and muffling of engines is required for fire prevention pursuant to State Standards.

Copies of the Regulations published in the Federal Register vol. 38 No. 245 published December 21, 1973 and a draft of GRO Order No. 4, Federal Register vol. 40, No. 19, published January 28, 1975, should be included as appendices and referred to in the text.

Appendix B, recommended stipulations are acceptable as written.

STATE OF NEVADA
OFFICE OF THE STATE PLANNING COORDINATOR
CAPITOL COMPLEX
CARSON CITY, NEVADA 89701
(702) 885-4865

CHIEF, P&D
W/H & RA
W/L & REC.
GEO. SPEC.
REALTY
CHIEF, OP
USDI BLM RECEIVED B. MTN. D. C.
APR 24 1975
PROTECTION
ENG-SUR. AM
SUPERAH AM
CHIEF, ADMIN.
SUPV. CLK.
RECEPTION
ALT. FILE

April 21, 1975

District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain, Nevada 89820

RE: TONOPAH RESOURCE AREA EAR SAI # NV 75800025

Dear Sir:

Attached you will find comments from affected state agencies on the above referenced EAR.

We would appreciate it if you would incorporate them in your final Environmental Assessment Report.

Sincerely yours,

Bruce D. Arkell
State Planning Coordinator

BDA:bw
attachment
cc: Dept. of Agriculture
Fish and Game
Division of Health
Conservation

April 1, 1975

Mr. B. D. Arkell
Planning Coordinator
Governor's Office
Capitol Building
Room 57
Carson City, Nevada 89701

Dear Bruce:

We have reviewed the following environmental analysis records:

1. Baker Oil and Gas EAR - SAI # NV 75800024
2. Tonppah Resource Area EAR SAI # NV 75800025
3. Pine Nut-Walker Area EAR SAI # NV 75800026
4. Sonoma-Gerlach Resource Area Buffalo Hills Planning Unit SAI # NV 75800027

We support the above proposals as written.

In addition I am enclosing reviews and comment forms for previously received proposals.

Sincerely,

John L. O'Harra, D. V. M.
Administrator
Division of Animal Industry

JLO:kt
Enclosures

GLEN K. GRIFFITH
DIRECTOR

MIKE O'CALLAGHAN
GOVERNOR

VALLEY ROAD • P.O. BOX 10678 • RENO, NEVADA 89510 • TELEPHONE (702) 784-6219

April 11, 1975

Mr. Bruce Arkell
State Planning Coordinator
Governor's Office
Carson City, Nevada 89701

Dear Mr. Arkell:

Reference is made to draft "Regional Environmental Analysis Record, Geothermal/Oil and Gas Leasing in Pine Nut-Walker Area, Carson City District Nevada"; "Baker Oil and Gas Leasing, Ely District Nevada"; and "Geothermal Leasing in the Tonopah Resource Area, Battle Mountain District Nevada".

The basic assessment of the wildlife values incorporated in these areas has received sketchy treatment at best. There are extremely valuable wildlife resources within the three subject areas and insufficient information is present.

Therefore, the BLM should be put on notice that the Department of Fish and Game reserves the right to have included in any lease document that wildlife values exist and have been inadequately described in these Regional environmental analyses and the leasee shall be subject to limitations within the leased area depending upon the determinations of the Department of Fish and Game as to the effects that the subject leasing shall have.

If this sort of arrangement cannot be made allowing for fish and game limitation within the leased areas, then the Department of Fish and Game has no other recourse than to require a complete Environmental Impact Statement for the subject areas.

Sincerely,

GLEN K. GRIFFITH, DIRECTOR

By: A. Jack Dieringer
Assistant Chief
Division of Fisheries

AJD:vh

NEVADA
STATE
PARK
SYSTEM

MEMO

TO Norman Hall

FROM Eric Cronkhite

DATE April 9, 1975

SUBJECT GEOTHERMAL/OIL AND GAS LEASING ERA'S FOR: BUFFALO HILLS PLANNING UNIT, TONOPAH RESOURCE AREA, PINE NUT-WALKER AREA, AND BAKER N8674

We have reviewed the above reports. All of these reports contain extensive documentation dealing with archaeological and historical resources, and the measures proposed to mitigate the effects of the planned leasing on these resources. We have been working closely with the BLM state office to give archaeological and historic clearance to geothermal oil and gas leasing ERA's as soon as we receive written evidence of concurrence with the proposals by the Nevada Historical Society and the Nevada Archaeological Survey. We, therefore, wish to withhold our final action until this concurrence is received on each proposal.

The identification and mitigation of the recreational resources is adequately covered in each of these ERA's. This action is in accordance with the Statewide Comprehensive Outdoor Recreation Plan.

EC/MH/bc

RECEIVED
APR 9 1975
Department of Conservation
and Natural Resources

STATE OF NEVADA
DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH
BUREAU OF ENVIRONMENTAL HEALTH
CAPITOL COMPLEX
1209 JOHNSON STREET
CARSON CITY, NEVADA 89701

April 7, 1975

MEMORANDUM

TO: Bruce Arkell
State Planning Coordinator

FROM: Hugh Ricci
Public Health Engineer

SUBJECT: Regional Environmental Analysis on Geothermal Leasing in the Tonopah Resource Area

Upon review of this Environmental Analysis Record by the Environmental Protection Section, Bureau of Environmental Health of the Department of Human Resources, the following comments are submitted:

Air Quality

1. Monitoring should be done prior to any development to determine ambient air quantities of carbon monoxide, ozone, and particulate matter.

2. Chemical analyses of gases from the wells should be made to determine if any toxic gases are present.

3. Monitoring should continue to measure any changes in the ambient air due to development. Also, monitoring should be done to insure no toxic gases are released into the atmosphere.

4. Monitoring for radioactive elements from the gases should be done.

5. Care sould be taken when developing new roads in the area to prevent fugitive dust problems. Dust control measures should be taken.

6. On site preparation should disturb a minimum amount of vegitation. Dust control measures should be taken.

7. Upon abandonment, the area should be revegitated.

8. If any portion of the development comes under the Nevada Air Quality Regulations, the proper procedure must be adhered to by the developer.

Water Quality

No comments.

Solid Waste Management

No comments.

HR/dp

STATE OF NEVADA
DEPARTMENT OF FISH AND GAME
1100 VALLEY ROAD, RENO, NEVADA • TELEPHONE 784-6214
MAIL: P.O. BOX 10678, RENO, NEVADA 89510

MIKE O'CALLAGHAN
GOVERNOR

GLEN K. GRIFFITH
DIRECTOR

IN REPLY REFER TO:

EMPLOYEE	ACT
DM	
ENV. COORD.	
CHIEF, PM	
WVR & RATES	
LEE & REC.	
GEO. SPEC.	✓
REALTY	
CHIEF, OP	

USDI BLM RECEIVED S. MTN. D. O.
JAN 28 1975

PROTECTION		
SHO-EUR AM		
TONOPAH AM		
CHIEF, ADM		
SUPV. CLK		
RECORDS		
ALL EMPS.		

January 23, 1975

Mr. Gene Nodine
District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain, Nv. 89820

Dear Mr. Nodine:

Reference is made to your Environmental Analysis Record for geothermal leasing in the Tonopah Resource Area. Attached you will find a copy of "Water for Nevada #6 - Forecast for the Future-Fish and Wildlife".

Within this publication you will find a breakdown of the distribution of the areas fish and wildlife species throughout the State of Nevada are found. If this is insufficient for your needs, please contact our Region II & III offices for more specific information.

You can appreciate our problem in attempting to pinpoint specific critical environmental areas within the proposed leasing. We would appreciate reviewing your Environmental Analysis Report for additional input and this may assist in clarification.

Additionally, we request the right to review on a site by site basis each proposed geothermal lease.

If we can be of additional assistance to you, please do not hesitate to contact us.

Sincerely,

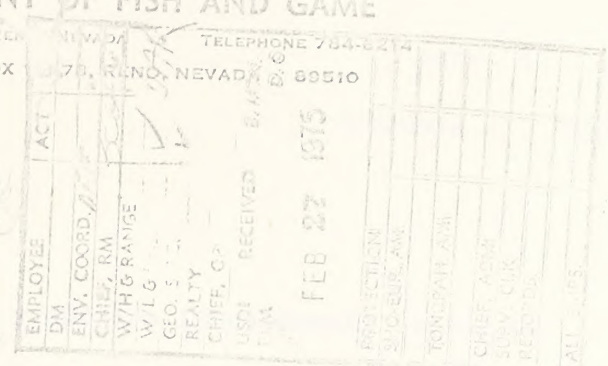
GLEN K. GRIFFITH, DIRECTOR

By: A. Jack Dieringer
A. Jack Dieringer
Assistant Chief
Division of Fisheries

STATE OF NEVADA
DEPARTMENT OF FISH AND GAME
1100 VALLEY ROAD, RENO, NEVADA TELEPHONE 784-6214
MAIL: P.O. BOX 678, RENO, NEVADA 89510

MIKE O'CALLAGHAN
GOVERNOR

GLEN K. GRIFFITH
DIRECTOR



IN REPLY REFER TO: Reg. III
4747 W. Vegas Drive
Las Vegas, Nv. 89108

February 25, 1975

Mr. Gene Nodine, District Manager
Battle Mountain District
Bureau of Land Management
P.O. Box 194
Battle Mountain, Nev. 89820

Dear Gene:

Please accept our apologies for such a late response to your letter of January 10, 1975 concerning wildlife input for your E.A.R. on geothermal leasing.

It would be extremely difficult to identify areas where protective measures for wildlife are needed from geothermal leasing activities when the extent of development and/or impacts will not be known until applications are made.

However, a list of important wildlife areas is outlined below in priority order including wildlife species involvement. The general areas are also outlined on the attached map in red pencil:

1. Railroad Valley WMA and surrounding area. Species involvement: all waterfowl species, shore birds, raptors, bighorn sheep, antelope and endemic fish species.

2. Little Fish Lake Valley Wildlife Habitat Area. Primary species involvement includes: sage grouse, waterfowl, antelope and deer.

3. Morey Bench Habitat Area. Primary species involvement: mule deer, sage grouse and chukar partridge.

4. Lower Stone Cabin Valley. Primary species involvement: antelope.

5. Revielle Valley. Primary species involvement: antelope

6. Monitor Valley. Potential conflicts with Nevada Department of Fish and Game proposed elk introductions on the Table (Monitor Range).

7. Willow Creek Habitat Area. Primary species: deer and antelope.

8. Saulisbury Wash Habitat Area. Primary species: mule deer

9. Indian Valley Habitat Area. Primary species: sage grouse

I trust this will either conform to your thoughts on this at such a late date or serve as general input from our Department.

Thank you for advising our Region concerning the E.A.R. and please feel free to call if you need more information or detail.

Sincerely,

John Donaldson
Supervisor

Ronald M. Lee

By: Ronald M. Lee
Reg. Asst.-Game

RML:mhb
Cc: Game Division

Attach.

NEVADA STATE HISTORICAL SOCIETY

Founded 1904

CHIEF, OP
W/R & RANGE
W/L & REC.
GEO. SPEC.
REALTY
CHIEF, OP
USDI BLM RECEIVED B. MTN. D. O.
JAN 13 1975
PROTECTION
SHO-EUR AM.
TONOPAH AM.
CHIEF, ADM.
SUPV. CLK.
RECORDS
ALL EMPS.

January 9, 1975

Gene Nodine, District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain, NV 89820

Dear Mr. Nodine:

Reference is made to your letter of January 8th concerning an Environmental Analysis Record for geothermal leasing.

The area outlined in your map includes thousands of historic sites. It is impossible to list or identify them without a great deal of work, involving possibly man-years of effort.

It is important that potential lessees obligate themselves tobe responsible for any impact their crews for prospecting or field work cause. Also, any drilling site should be cleared by knowledgeable professionals prior to any work.

To allow unsupervised prospecting or field work with no protection of historic values would be resisted by this office.

Sincerely,

John M. Townley
Director

MIKE O'CALLAGHAN
Governor

NEVADA
STATE
PARK
SYSTEM

ERIC R. CRONKHITE
Administrator

ROOM 221
NYE BUILDING
201 S. FALL STREET
CARSON CITY
NEVADA 89701
702/882-7339
702/635-5220

January 27, 1975

DM
ELKO DIST.
CHIEF, OP
W/H & F SPEC.
W/L & F SPEC.
GEO. SPEC.
REALTY
CHIEF, OP
USDI BLM RECEIVED FEB 5 1975 BLM MT'L D/O
PROTECTION
SHO-EUR. AM
TONOPAH AM
CHIEF, ADM
SUPV. CLK
RECORDS
ALL EMPS.

Mr. Gene Nodine
District Manager
Bureau of Land Management
P.O. Box 194
Battle Mountain, Nevada 89820

Dear Mr. Nodine:

Subject: 3200 (N-063)

Please find on the attached BLM map outlining the Tonopah Resource Area the historical and archeological sites which we believe should be given special protective measures. We are also including the county inventories from our State-wide Historic Preservation Plan with the sites within the resource area identified. (✓)

We would like to urge that the lease agreements stipulate that any new historical/archeological sites that may be discovered during the course of geothermal exploration and development be properly assessed by professional archeologists, and that mitigating measures be taken to survey and/or protect these sites.

If you require more information, please contact our office.

Sincerely,

Eric R. Cronkhite
State Historic Preservation Officer

ERC:vp

Attachment

COUNTY INVENTORY

EUREKA COUNTY

County Inventory of Historic Sites

I. Aboriginal Americans

II. The Arts

III. Conservation

1. Toiyabe National Forest (a portion)

IV. Education

V. Exploration and Settlement

1. Beowawe
2. Diamond Springs (Pony Express, Stage)
3. Eureka
4. Eureka County,
5. Gravelly Ford
6. Grubb's Well
7. Roberts Creek (Pony Express)
8. Simpson's Wagon Road (a portion)
9. Sulphur Spring (Pony Express)

VI. Military Affairs

1. Camp Winthrop

VII. Political Affairs

1. Eureka County Courthouse

VIII. Recreation

IX. Science

X. Society

XI. Technology

1. Alpha (no remains)
2. Beowawe
3. Buckhorn
4. Eureka
5. Eureka-Palisade RR
6. Mineral Hill
7. Palisade
8. Ruby Hill

COUNTY INVENTORY

LANDER COUNTY

County Inventory of Historic Sites

I. Aboriginal Americans

1. Austin
2. Grass Valley
3. Hickison Summit
4. Toquima Cave

II. The Arts

1. Reese River Reveille, Austin

III. Conservation

1. Toiyabe National Forest (a portion)

IV. Education

V. Exploration and Settlement

1. Austin
2. Battle Mountain
3. Cape Horn
4. Dry Well (Dry Creek)
5. Jacobsville (or) Jacob's Well
6. Lander County
7. Mount Airy
8. Simpson Park
9. Simpson's Wagon Road (a portion)
10. Smith Creek

VI. Military Affairs

VII. Political Affairs

VIII. Recreation

IX. Science

X. Society

1. Reuel Colt Gridley store (Austin)

County Inventory - Lander County

IX. Technology

1. Amador
2. Austin
3. Bannock
4. Battle Mountain
5. Battle Mountain RR
6. Battle Mountain & Lewis RR
7. Betty O'Neal
8. Bullion
9. Bunker Hill
10. Canyon City
11. Central Pacific RR
12. Copper Basin
13. Copper Canyon
14. Corten
15. Dean
16. Galena
17. Geneva
18. Gold Acres
19. Guadelajara (Santa Fe)
20. Hilltop (Kimberly)
21. Kingston
22. Lander
23. Lander City
24. Lewis
25. Nevada Central RR
26. Pittsburg
27. Tenabo

COUNTY INVENTORY

NYE COUNTY

County Inventory of Historic Sites

I. Aboriginal Americans

1. Ammonia Tanks (or Spring)
2. Antelope Spring
3. Ash Meadows
4. Beatty (Shoshone)
5. Belmont-Shoshone
6. Big George Cave
7. Big Smoky Valley
8. Cane Spring
9. Duckwater
10. Forty-mile Canyon
11. Grantsville
12. Hot Creek Valley
13. Ione Valley
14. Johnny-Johnnies Water Cave
15. Manhattan (Shoshone Festivals)
16. Pahrump Valley
17. Paiute Mesa
18. Paradise Range
19. Railroad Valley
20. Ranier Mesa
21. Reese River Valley
22. Reveille
23. Tippipah Spring
24. West Union Canyon
25. Whiterock Spring
26. Yomba Indian Reservation

II. The Arts

III. Conservation

1. Humboldt National Forest (a portion)
2. Toiyabe National Forest (a portion)

IV. Education

V. Exploration and Settlement

1. Amargosa River
2. Baxter Springs
3. Beatty
4. Belmont
5. Belmont Courthouse
6. Ichthyosaur State Park
7. Nye County Development due to Union Mining District

VI. Military Affairs

VII. Political Affairs

1. Nye County Courthouse (Belmont)

VIII. Recreation

County Inventory - Nye County

IX. Science

1. Nevada Proving Grounds (a portion)

X. Society

XI. Technology

1. Amargosa City
2. American Carrara Marble Co. RR
3. Arrowhead
4. Ash Meadows
5. Atwood
6. Barcelona
7. Beatty--
   - Tonopah & Tidewater RR
   - Bonnie Clare RR (Thorpe)
   - Bullfrog-Goldfield RR
   - Las Vegas & Tonopah RR
   - Tonopah & Goldfield RR
8. Bellehelen
9. Belmont
10. Berlin
11. Carrara
12. Central
13. Clifford
14. Danville
15. Downeyville
16. Ellendale
17. Ellsworth
18. Gold Center
19. Gold Crater
20. Golden Arrow
21. Goldyke
22. Gransville
23. Hannapah
24. Hot Creek
25. Ione
26. Jefferson
27. Johnnie
28. Kawich
29. Gold Reed
30. Lodi —
31. Lost Breyfogle Mine
32. Manhattan
33. Monarch
34. Morey
35. Northumberland
36. Ophir Canyon
37. Park Canyon
38. Phonolite —
39. Pioneer —
40. Pueblo —
41. Quartz Mountain
42. Reveille
43. Rhyolite & Bullfrog
44. Round Mountain
45. San Antone
46. Silverbow
47. Tonopah
48. Troy
49. Tybo
50. Wahmonie
51. Washington
52. West Union Canyon

NATIONAL PUBLIC LANDS TASK FORCE

NEVADA OUTDOOR RECREATION ASSOCIATION, INC.

HONORARY LIFE MEMBERS

Charles S. Watson, Jr.
Carson City, Nevada

Alvin McLane
Reno, Nevada

Anthony D. Rosso
Arvada, Colorado

Darwin Lambert
Luray, Virginia

Sonia De Hart
Genoa, Nevada

Sumner L. Evans
Sparks, Nevada

Gerald E. Foreman
Port Tobacco, Maryland

Dr. Vincent P. Gianella
Auburn, California

Harold A. Kantrud
nestown, North Dakota

Landon J. Lockett III
Austin, Texas

Dr. David L. Lyon
Mt. Vernon, Iowa

Virlis Fischer
Las Vegas, Nevada

George Hudson
Pullman, Washington

Carmelita Lowry
St. Louis, Missouri

Steve Francis
Sparks, Nevada

M. Burrell Bybee
Ely, Nevada

B. Riley McClelland
Missoula, Montana

Rex and Muriel Lund
Unionville, Nevada

IN MEMORIAM

George Kell
Sparks, Nevada

George Lund
Unionville, Nevada

Charles Rago
Sparks, Nevada

James G. Halse, Sr.
Pioche, Nevada

January 16, 1975

DISTRICT
DIST. MGR.
CHIEF, I&M
WTR & RANGE
W/L & REC.
GEO. SPEC.
REALTY
CHIEF, OP
USDI BLM RECEIVED B. MTN. D. C.
JAN 24 1975
PROTECTION
SHO-EUR. AM
TONOPAH AM
CHIEF, ADM
SUPV. CLK
RECORDS
ALL EMPS.

Gene Nodine
District Manager
Battle Mountain District
U.S. Bureau of Land Management
P.O. Box 194
Battle Mountain, Nevada 89820

Dear Mr. Nodine:

Enclosed is a generally anotated map delineating sites and areas in the NEVADA OUTDOOR RECREATION RESOURCES INDEX & SURVEY in the Tonopah Resource Area, per your request of January 10, 1975

You'll be interested in knowing that this organization's field investigator, Alvin McLane, has recently written a report recommending natural landmark status for the proposed Morey Peak Primitive Area. We have just added to the NORA Index & Survey some remarkable photographs of the ancient bristlecone pines now known to exist on the highest peaks of the Morey Peak massif. With this new information, added to the other remarkable phenomenon(the unique desert-bound waterfall areas, painted pinnacles and petroglyphs), we have excellent reason to believe this should be the top priority area within the Tonopah Resource Area.

We have recommended to our lawyers at NRDC, Palo Alto, Cal., that this area(Morey Peak) should be on any list of top priority areas on BLM public lands in Nevada, to be submitted to the District of Columbia federal court, per Judge Thomas Flannery's decision relating to the preparation of NEPA impact statements.

Sincerely,

Charlie Watson

Charles S. Watson, Jr.
Director
P.O. Box 1245
Carson City, Nevada 89701

SIERRA CLUB

FOUNDED IN 1892

Toiyabe Chapter - Nevada and Eastern California

January 23, 1975

EMPLOYEE INITIALS
DIST. MGR.
CHIEF, RM
W/L & RANGE
W/L & REC.
GEO. SPEC.
REALTY
CHIEF, OP
USDI BLM RECEIVED B. MTN. D. O.
JAN 27 1975
PROTECTION
SHO-EUR-AM
TONOPAH SM
CHIEF, ADM.
SUPV. CLK.
RECORDS
ALL EMPS.

Gene Nodine
District Manager
Battle Mountain District
Bureau of Land Management
P. O. Box 194
Battle Mountain, Nevada 89820

Dear Mr. Nodine:

In reply to your letter, January 10, 1975, we believe the following localities take highest priority for special protective status:

1. Morey Peak (primitive area)
2. Mt. Jefferson (wilderness)
3. Toiyabe Dome (wilderness)
4. Grant Range (joint primitive area and wilderness).

I must apologize for not delineating actual area boundaries on the map but with only twenty days notice this material could not be brought together. However, we generally endorse the sites and areas recognized in the "Nevada Outdoor Recreation Resources Index and Survey" as submitted by Charles Watson.

Given adequate notice we will prepare specific recommendations for the localities mentioned.

Sincerely yours,

Stephen R Francis

Stephen R. Francis
Chairman, Toiyabe Chapter

WHOA!
WILD HORSE ORGANIZED ASSISTANCE
INC.
A Foundation for the Welfare of
Wild Free-Roaming Horses and Bu

BOARD OF TRUSTEES
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JOHN REILLY
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P. O. Box 555
Reno, Nevada 89504
Telephone 323-5908
Area Code 702

	ACT	INFO
DM		
ENV. COORD.		
CHIEF, RM		
W/H & RANGE		
W/L & REC.		
GEO. SPEC.	✓	
REALTY		
CHIEF, OP		

USDI BLM RECEIVED B. MTN. D. O.
JAN 31 1975

PROTECTION		
SHO-EUR. AM.		✓
TONOPAH AM.		✓
CHIEF, ADM.		
W. CLK.		
RECORDS		
ART. FARRS.		

copy to Hyndeph
done
1-31-75

January 28, 1975

Mr. Gene Nodine
District Manager, Battle Mountain
Bureau of Land Management
P.O. Box 194
Battle Mountain, Nevada 89820

Dear Mr. Nodine:

Thank you very much for the oppotunity to make available to you our recommendations for the Environmental Analysis Record on geothermal leasing in the Tonopah area.

Reference is made to Carver's Station and Darrough Hot Springs located in Big Smokey Valley. Because of existing human disturbance in that area, wild horses would not likely be so adversely affected as in the area that has heretofore been undisturbed. Proximity of national forests east and west could allow horses in this particular area under consideration to have access to water which, according to our maps, is available in the national forests. It would also provide them a means of escape from human usurpation of their present habitat. Of course, all wildlife will be adversely affected anywhere that study or development occurs through the inevitable activity associated with human occupancy.

Possible geothermal leasing in the Warm Springs area presents a serious threat to wild horse survival. The horses migrate from the wild horse refuge into Kawich Range and Reville Valley to the north. I have been informed that this area has a larger concentration of wild horses and naturally disturbance would be far more reaching. There is also a high degree of cattle grazing. Allegations of conflict between wild horses and domestic livestock over feed and water in this area are constantly being made by ranchers, with the wild horses being denied access, in many instances, to either or both. With the additional enchroachment onto their habitat through geothermal leasing, the future of wild horses would indeed be precarious.

According to the U. S. G. S. maps, wells and watering holes exist, but two field trips into this area last summer showed them to be dried up. With near-drought conditions during 1974, and the probability of worse conditions in 1975, what thought would be given to providing additional grazing to insure the survival of the wild horses? The area is critical now! How can a development that will allow for additional human enchroachment make it any better?

The proposed development of geothermal energy in the proximity of Warm Springs, because of the area being bounded on the West by the Monitor Range, and on the East by Reveille Valley and on the South by the bombing range, would quite conceiveably force the horses to the North away from the refuge that was established for them in 1962.

If the area under study is North of Warm Springs, this situation would reverse itself and the horses would migrate to the South into their own protected range, crowded through we know it is through domestic livestock trespass. Water would still be a question, but there would be a far greater area in which to develop water.

Location of the study in relation to Warm Springs would make a difference in the entire situation, but in no event do we see it as beneficial to the wild horses in any way. We strongly recommend that protective measures be taken to minimize disturbance to wild horses in any areas of proposed geothermal leasing and that every effort be directed toward alleviating the existing paucity of forage and water available to the.

Most sincerely,

Dawn Lappin

Dawn Y. Lappin
for WHOA!

United States Department of the Interior

FISH AND WILDLIFE SERVICE

~~BUREAU OF SPORT FISHERIES AND WILDLIFE~~

Division of River Basin Studies
4620 Overland Road
Boise, Idaho 83705

DIST. OFFICE
WYO. NEV.
GEO. SPEC.
REALTY
CHIEF, OP.
USDI RECEIVED BLM MTN. D. C.
JUN 13 1975
INSTRUCTION
JHO FUR. AM.
TONOPAH AM.
CHIEF, ADM.
SUPV. CLK.
RECORDS
FILE NAME

June 11,

Mr. Gene Nodine, District Manager
Battle Mountain District
Bureau of Land Management
Battle Mountain, Nevada 89820

Dear Mr. Nodine:

We appreciate the opportunity to review the EAR on geothermal leasing in the Tonopah Resource Area (27-060-5-30), that we received June 9, 1975. We understand that this document has been reviewed by the Nevada State Clearing House and is scheduled for finalization in mid-June. Because of the short review period, we were unable to evaluate and provide you information as adequately as desired. We did identify some major areas of concern, and they are as follows.

General Comments

The EAR should be expanded to identify fish and wildlife and discuss their respective habitats. Further, the integrity of delicate desert ecosystems surrounding springs and streams should be discussed, and measures to guarantee the preservation of water quality necessary for the perpetuation of aquatic systems should be identified.

Mitigating and compensating measures for critical habitat losses should be discussed in detail. We do not agree that, "The production of energy . . . could be considered a mitigating measure in itself." The loss of wildlife habitat cannot be mitigated by the production of power.

Appendix B should be expanded to include animals other than the wild horse. Lands should be identified that have habitats for raptors, antelope, and endangered fauna. Known endangered fauna habitats should be exempted from lease as required by Title 43, Subchapter C, Part 3000, Section 3201.1-6, and questionable sites should be held in abeyance until sufficient data are collected to justify a decision.

Your decision to control activities on critical wildlife habitats by restriction of surface disturbances is not satisfactory. We agree that properly regulated, this could be sufficient during the exploration period. However, once a well has proven successful, we foresee the sacrifice of all wildlife values for the production of a power production facility.

Based on the data presented in the EAR, the irreversible and irretrievable commitments are incomplete. Wildlife movements, population losses, habitat destruction, and the change from a multiple-use wildlife-livestock plan to a single-use industrial complex should be documented.

Specific Comments

Page 38: All watering areas that are classified as critical to wildlife needs should be exempted from leasing and have a 1/4-mile surrounding buffer zone with access corridors for wildlife movements. Spencer Hot Springs should be monitored for possible incidence of spotted bats, Euderma maculatum.

Page 39, Animals: This section should discuss the impacts on sage grouse strutting and brood-rearing areas, antelope kidding grounds, raptor nesting sites, etc.

Page 43, 6.-Living components, paragraph 2: Any loss of surface water cannot be permitted in such a water-barren area. Stipulations to terminate all drilling if surface water losses occur should be included in the lease agreement.

Page 44: Studies should be conducted to determine Lahontan cutthroat trout distributions. To guarantee protection of streams, lakes, ponds, and streams, all should have a 500-ft. lease-exempt buffer zone. There should be a 1000-ft. buffer zone along streams and springs with known endangered wildlife; and no wells, water storage facilities, or other facility that might contribute to water contamination should be constructed on high ground that slopes directly to an aquatic habitat or stream.

Page 44: All transmission lines should be designed to reduce the incidence of electrocutions and raptor strike mortalities. We recommend that Morley Nelson's guidelines be used.

Page 53, VII--Recommended Mitigating Measures: We suggest that to reduce losses of remoteness which is essential to the survival of many wildlife species, all geothermal roads be treated as private roads, with travel restricted to lessees and responsible government agency vehicles. These roads should be posted, and be the responsibility of the lessee.

Page 55: The irreversible and irretrievable commitments of resources are sufficient to require formulation of an Environmental Impact Statement. Formulation of an EAR for impacts of this severity does not fulfill the intent of NEPA, 1969, U.S.C., Sec. 4321 et seq.,

Public Law 91-90, Sec. 102(2)(C), which was interpreted on April 23, 1970, by the Circuit Court of the District of Columbia, to mean an Environmental Impact Statement.

We would be happy to discuss any of the above, if you have questions. Our number is FTS 8 - 208 - 342-2631.

Sincerely,

Richard J. Fisher

Richard J. Fisher
Field Supervisor

LEGEND FOR MAPS ATTACHED TO THIS DOCUMENT

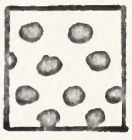
BIG HORN SHEEP STIPULATION

DEER HABITAT STIPULATION

AREAS UPON WHICH FURTHER STUDY WILL BE REQUIRED PRIOR TO LEASING

SAGE GROUSE STIPULATION

LIVE WATERS STIPULATION



EROSIVE SOILS STIPULATION

NO LEASING

Bureau of Land Management
Library
Denver Service Center

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

CALIENTE

VSGZ, EDITION 4

Prepared by the U.S. Army Topographic Command (USATC), Washington, D.C. Compiled in 1955 by photogrammetric methods and from United States quadrangles 1:50,000, 1952. Planimetry revised from aerial photographs taken 1952. Photographs field annotated 1954. Revised by the U.S. Geological Survey 1970.

Location of geodetic control established by government agencies is shown on corresponding 1:250,000-scale Geodetic Control Diagram

LEGEND

POPULATED PLACES
Over 500,000 — LOS ANGELES
100,000 to 500,000 — OMAHA
25,000 to 100,000 — GALVESTON
5,000 to 25,000 — Laramie
1,000 to 5,000 — Grand Coulee
Less than 1,000 — Sun Valley

RAILROADS
Standard gauge
Narrow gauge

BOUNDARIES
International
State
County
Park or reservation

ROADS
Primary, all weather, hard surface
Secondary, all weather, hard surface
Light-duty, all weather, hard or improved surface
Fair or dry weather, unimproved surface
Trail
Interchange
Route markers: Interstate; U.S.; State

Landplane airport
Landing area
Seaplane airport
Seaplane anchorage
Woods-brushwood

Mine
Landmark: School; Church; Other
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

Scale 1:250,000

CONTOUR INTERVAL 200 FEET

TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID: ZONE 11

MAGNETIC DECLINATION FOR 1970 IS 15°E (210 MILS) EASTERLY OVER THE ENTIRE AREA

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM

CALIENTE, NEVADA; UTAH

1954

REVISED 1970

STOCK NO. VSGZNJ11 9 1-04

STOCK NO V502XNJ1118***95

GOLDFIELD, NEVADA, CALIFORNIA
1954
REVISED 1970

USGS, EDITION 5
Prepared by the U.S. Army Topographic Command (USATC), Washington, D.C. Compiled in 1958 by photogrammetric methods and from United States stereoplanigraphic 1:50,000 1:62 Photomosaic printed from aerial photographs taken 1949. Photogrravity field established 1954. Revised by the U.S. Geological Survey 1970.
Location of geodetic control established by government agencies is shown on corresponding 1:250,000-scale Geodetic Control Diagram

LEGEND

LOS ANGELES
OMAHA
GALVESTON
Langtrees
Grand Coulee
Sun Valley

Scale 1:250,000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM

V502, EDITION 3

Prepared by the U.S. Army Topographic Command (USTOPO), Washington, D.C. Compiled in 1956 by photogrammetric methods from aerial photographs taken 1952-54. Photographs field annotated 1956. Revised by the U.S. Geological Survey 1970.

Location of geodetic control established by government agencies is shown on corresponding 1:250,000-scale Geodetic Control Diagram

LEGEND

POPULATED PLACES
Over 500,000 — LOS ANGELES
100,000 to 500,000 — OMAHA
25,000 to 100,000 — GALVESTON
5,000 to 25,000 — Laramie
1,000 to 5,000 — Grand Coulee
Less than 1,000 — Sun Valley

RAILROADS
Standard gauge
Narrow gauge

BOUNDARIES
International
State
County
Park or reservation

ROADS
Primary, all weather, hard surface
Secondary, all weather, hard surface
Light duty, all weather, hard or improved surface
Fair or dry weather, unimproved surface
Trail
Interchange
Route markers, Interstate, U.S., State

Landmark object
Landing area
Seaplane anchorage
Seaplane ramp
Boats, shipwreck

Windmill
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

Scale 1:250,000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS

TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11

1970 MAGNETIC DECLINATION FROM TRUE NORTH AT CENTER OF SHEET

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM

LUND, NEVADA, UTAH
1956
REVISED 1970

STOCK NO. V502ANJ11616**03

TOIYABE NATIONAL FOREST

TOIYABE NATIONAL FOREST

TOIYABE NATIONAL FOREST

TONOPAH

V502, EDITION 3

Prepared by the U.S. Army Topographic Command (USTOPO), Washington, D.C. Compiled in 1956 by photogrammetric methods from aerial photographs taken 1952-54. Photographic field annotated 1956. Revised in 1971 by the U.S. Geological Survey from aerial photographs taken 1971.

Location of geodetic control established by government agencies as shown on corresponding 1:250,000 scale Geodetic Control Diagram.

LEGEND

POPULATED PLACES
Over 500,000 — LOS ANGELES
100,000 to 500,000 — OMAHA
25,000 to 100,000 — GALVESTON
5,000 to 25,000 — Laramie
1,000 to 5,000 — Grand Cooke
Less than 1,000 — Sun Valley

RAILROADS
Normal gauge — Single track; double track
Narrow gauge — Abandoned; under construction

BOUNDARIES
International
State
County
Park or reservation

Landplane airport
Landing area
Seaplane airport
Seaplane anchorage
Woods-brushwood

ROADS
Primary, all weather, hard surface
Secondary, all weather, hard surface
Light duty, all weather, hard or improved surface
Fair or dry weather, unimproved surface
Trail
Interchange
Route markers: Interstate, U.S., State

Mine
Landmark School, Church, Tower
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

Scale 1:250,000

0 5 0 5 10 15 20 Statute Miles
0 5 0 5 10 15 20 25 30 Kilometers
0 5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS

TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 6-DEGREE UNIVERSAL TRANSVERSE MERCATOR GRID ZONES

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20244

ELEVATION DIAGRAM

TONOPAH, NEVADA
1956
REVISED 1971

STOCK NO. V502XNJ11S ***03

N

EUREKA

LANDER

FREMONT TRAIL 1845

SIMPSON WAGON ROAD

AUSTIN

PONY EXPRESS OVERLAND MAIL

KINGSTON

WASHINGTON

NORTHUMBERLAND

DANVILLE

MOREY

HOT CREEK

TYBO

TYBO CHARCOAL OVENS

JEFFERSON

OPHIR

ROUND MTN.

BARCELONA

BELMONT

TROY

CLIFFORD

ARROWHEAD

REVEILLE

BELLEHELEN

EY

HANNAPAH

SILVERBOW

BAXTER SPRING

TONOPAH

SAN ANTONE

ICHTHYOSAUR STATE PARK

IONE

GRANTSVILLE

ANTELOPE SPRING

QUARTZ MTN. PHONOLITE

ELLSWORTH

DOWNEYVILLE

ATWOOD

GOLDYKE

10 0 10 20 30

LEGEND

NOMINATED SITES

POTENTIAL SITES

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TONOPAH RESOURCE AREA

NATIONAL REGISTER of HISTORICAL PLACES

Bureau of Land Management
Library
Denver Service Center

TD 195 .E4 B388 1975
U. S. Bureau of Land
Management. Battle Mountain
Regional environmental
analysis on geothermal

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
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DENVER, CO 80225